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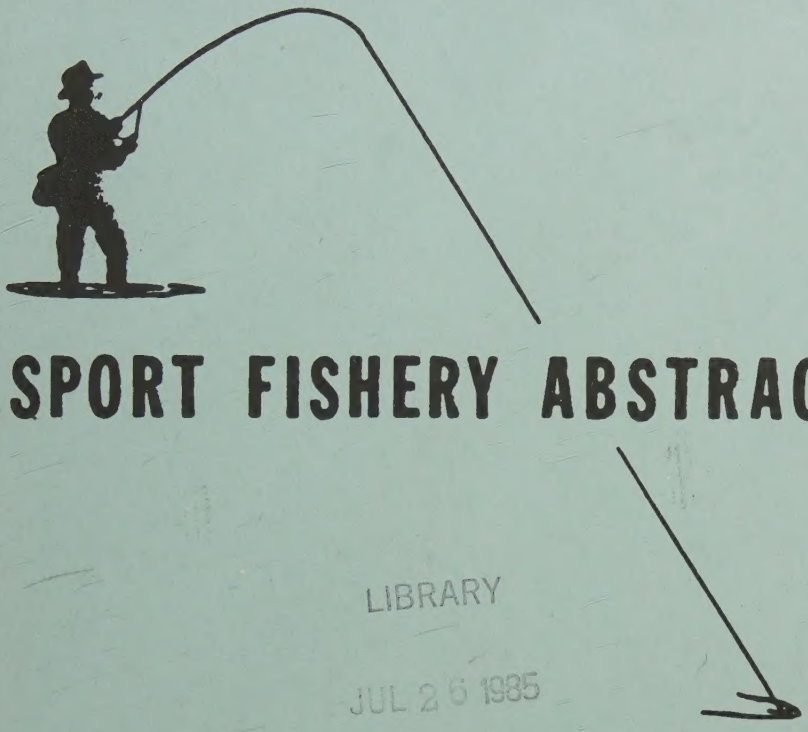

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Sport Fishery Abstracts is intended to furnish fishery biologists with abstracts of current literature in sport fishery research and management.

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[Little Harbor Lab., Inc., 69 Andrews Rd., Guilford, CT 06437] Egg, larval and osteological development of the northern searobin, *Prionotus carolinus*, is described, principally from laboratory reared specimens. Egg diameter ranges from 0.87 to 0.97 mm, and the egg contains 11 to 37 oil globules, which migrate to various locations within the egg during development. Gastrulation occurs at 27 hr, embryo is halfway around the yolk at 52 hr, and hatching occurs between 120 and 155 hr at 15°C. Prominent pigmentation of the embryo consists of a dark cluster of chromatophores just posterior to the developing eye and the beginning of a transverse band halfway between the vent and notochord tip just prior to hatching. Newly-hatched larvae range from 2.8 to 3.1 mm. The transverse band of pigment is fully developed and is an important characteristic in identifying early *P. carolinus* larvae. The pectoral fins are present at hatching and remain a characteristic feature. Adult meristics are complete by 7.00 mm. Larval head length increases during development becoming 37.5% of the body length during flexion. After flexion, head size decreases to that of an adult (32%). All bones are differentiated and the majority fully ossified at 24.0 mm. Cranial spines are present at 4.0 mm and additional spines in the opercle complex at 7.0 mm. Subsequent

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[Dep. Ethol. Wildl. Res., Inst. Zool., Univ. Zurich, Switzerland]

85-001355 Moss, J. L. SUMMER SELECTION OF THERMAL REFUGES BY STRIPED BASS IN ALABAMA RESERVOIRS AND TAILWATERS. *Trans. Am. Fish. Soc.* 114(1):77-83. 1985. SFA 30(2)
[Ala. Dep. Conserv. Nat. Resour., Game Fish Div., Fish. Sect., Montgomery 36130]

85-001356 Mrowka, W. BROOD DEPRIVATION AND THE CONTROL OF MOUTHBROODING IN *PSEUDOCRENILABRUS MULTICOLOR* (CICHLIDAE). *J. Comp. Ethol.* 67(1-4):34-44. 1985. SFA 30(2)
[Zool. Inst. Tech. Univ., Pockelstr. 10a, D-3300, Braunschweig, West Germany]

85-001357 Peterson, N. P. and L. M. Reid. WALL-BASE CHANNELS: THEIR EVOLUTION, DISTRIBUTION, AND USE BY JUVENILE COHO SALMON IN THE CLEARWATER RIVER, WASHINGTON. *Proc. Olympic Wild Fish Conf.* p. 215-225. 1984. Proceedings available @ $15.00 from Dr. J. M. Walton, Peninsula Coll., 1502 E. Lauridsen Blvd., Port Angeles, WA 98362. SFA 30(2)
[Wash. Dep. Fish., P.O. Box 9155, Yakima 98909] Wall-base channels are a

BEHAVIOR (CONTINUED)

85-001357 CONTINUED type of channel formed on floodplain or terrace surfaces by the channeling of runoff through swales created by the migration of the mainstem stream. Channels appear to develop either along abandoned meander scars or in swales between scroll bars, but in most cases follow the foot of the valley- or upper terrace-wall quite closely. Such channels are heavily colonized by coho salmon fry in late spring and again in autumn. Where the channels are associated with ponds or swamps they form a highly productive habitat for the overwintering fish. Productivity varies between sites and is related to the physical characteristics and stage of geomorphological development of the channels and ponds. Under present conditions a significant proportion of the smolts produced by the Clearwater basin comes from wall-base channels, and the importance of this habitat is expected to be even greater for higher levels of escapement.

85-001358 Powell, J. A. OBSERVATIONS OF CLEANING BEHAVIOR IN THE BLUEGILL (*LEPOMIS MACROCHIRUS*), A CENTRARCHID. *Copeia* 1984(4):996-998. 1984. SFA 30(2)
[Inst. Mar. Stud., HF-05, Univ. Wash., Seattle 98195]

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[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1F6, Canada]

85-001360 Ries, R. D. THE UTILIZATION OF STREAM HABITAT BY ARCTIC GRAYLING (*THYMALLUS ARCTICUS*). *Ohio J. Sci.* 85(2):96. 1985. Abstract only. SFA 30(2)
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85-001362 Romero, A. RESPONSES TO LIGHT IN CAVE AND SURFACE POPULATIONS OF *ASTYANAX FASCIATUS* (PISCES: CHARACIDAE): AN EVOLUTIONARY INTERPRETATION. *Ph.D. dissertation, Univ. Miami* 147p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(8):2470. 1985. SFA 30(2)

85-001363 Sager, D. R.; C. H. Hocutt and J. R. Stauffer, Jr. PREFERRED WAVELENGTHS OF VISIBLE LIGHT FOR JUVENILE ATLANTIC MENHADEN. *N. Am. J. Fish. Manage.* 5(1):72-77. 1985. SFA 30(2)
[Horn Point Environ. Lab., Univ. Md., P.O. Box 775, Cambridge, MD 21613-0775]

85-001364 Sampath, K. and T. J. Pandian. EFFECTS OF SIZE HIERARCHY ON SURFACING BEHAVIOUR AND CONVERSION RATE IN AN AIR-BREATHING FISH *CHANNA STRIATUS*. *Physiol. Behav.* 34(1):51-55. 1985. SFA 30(2)
[Dep. Zool., Aditanar Coll. Arts Sci., Tiruchendur 628 216, India]

85-001365 Sazima, I. and C. Zamprogno. USE OF WATER HYACINTHS AS SHELTER, FORAGING PLACE, AND TRANSPORT BY YOUNG PIRANHAS, *SERRASALMUS SPILOPLEURA*. *Environ. Biol. Fishes* 12(3):237-240. 1985. SFA 30(2)

BEHAVIOR (CONTINUED)

85-001365 CONTINUED
[Dep. Zool., Univ. Estadual Campinas, 13100 Campinas, São Paulo, Brazil] The water hyacinth, *Eichhornia crassipes*, plays an important role in the early life of the piranha, *Serrasalmus spilopleura* in southeastern Brazil. Larvae and early juveniles are found by both day and night among the roots of this free floating waterweed, thus gaining shelter, a rich foraging place, and potential rafting dispersal. Piranha larvae up to 19 mm SL feed mainly on small aquatic arthropods, slowly searched for inside the root tangle; larger juveniles tend to leave the plants and patrol more open areas. At 24 mm SL young piranhas begin to clip out pieces from fins of other fishes and seek shelter in water hyacinths only at night. About 30% of the rafting clumps of water hyacinths may harbour one to three piranha larvae, providing dispersal during floods.

85-001366 Serebrov, L. I. STRUCTURE AND SOME PECULIARITIES OF GROUP INTERACTION OF CAPELIN, *MALLOTUS VILLOSUS VILLOSUS* (OSMERIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):16-25. 1984. SFA 30(2)
[PINRO, Murmansk, USSR]

85-001367 Steele, C. W. ABSENCE OF A TIDAL COMPONENT IN THE DIEL PATTERN OF LOCOMOTORY ACTIVITY OF SEA CATFISH, *ARIUS FELIS*. *Environ. Biol. Fishes* 12(1):69-73. 1985. SFA 30(2)
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85-001368 Tyus, H. M. HOMING BEHAVIOR NOTED FOR COLORADO SQUAWFISH. *Copeia* 1985(1):213-215. 1985. SFA 30(2)
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85-001371 Yanushaytis, P. P. and S. K. Mal'kyavichyus. STROBOSCOPIC UNITS AND THEIR UTILIZATION FOR STUDYING VISION IN FISHES. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):175-178. 1984. SFA 30(2)
[Klaypeda Br. Commer. Fish. Res.-Prod. Dir., USSR]

LIFE HISTORY-GENERAL WORKS

85-001372 Angelescu, V. [TROPHIC ECOLOGY OF THE MACKEREL OF THE ARGENTINE CONTINENTAL SHELF. (SCOMBRIDAE, *SCOMBER JAPONICUS MARPLATENSIS*). PART I. FEEDING AND GROWTH.] *Rev. Invest. Desarr. Pesq.* 1:5-44. 1979. In Spanish with English summ. SFA 30(2)

85-001373 Aprahamian, M. W. and C. D. Barr. THE GROWTH, ABUNDANCE AND DIET OF O-GROUP SEA BASS, *DICENTRARCHUS LABRAX*, FROM THE SEVERN ESTUARY. *J. Mar. Biol. Assoc. U.K.* 65(1):169-180. 1985. SFA 30(2)

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001373 CONTINUED
[Freshwater Fish., Dep. Zool., Univ. Liverpool, Brownslow St., P.O. Box 147, Liverpool L69 3BX, England] Postlarval bass with a mean fork length of approximately 15 mm were first recorded in the upper reaches of the Severn Estuary at the end of July to the beginning of August. Juveniles, taken from Power Station intake samples, lower down the estuary, did not appear until September; reasons for this are discussed. The majority of the juveniles remained in the inner estuary until October, after which they migrated seawards. Relatively few were caught later. The relationship between wet weight (g) and fork length (mm) was described by the equation $W=9.126 \times 10^{-6} L^{3.142}$. The main components of the diet were mysids and calanoid copepods though gammarids and corophiums were also important.

85-001374 Bailey, T. G. DISTRIBUTION, ABUNDANCE, AND ASPECTS OF THE LIFE HISTORIES OF MIDWATER FISHES FROM THREE REGIONS OF THE EASTERN NORTH PACIFIC. *Ph.D. dissertation, Univ. Calif. (Santa Barbara)* 169p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(9):2814. 1985. SFA 30(2)

85-001375 Beacham, T. D. and S. J. Nepszy. SOME ASPECTS OF THE BIOLOGY OF WHITE HAKE, *UROPHYCIS TENUIS*, IN THE SOUTHERN GULF OF ST. LAWRENCE. *J. Northwest Atl. Fish. Sci.* 1:49-54. 1980. SFA 30(2)
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85-001376 Bernier, P. L. COMPARATIVE ECOLOGY OF THE FRECKLED AND FEATHERED BLENNIES (*HYPSOBLENNIUS IONTHAS* AND *H. HENTZI*) IN THE LOWER CAPE FEAR ESTUARY. *J. Elisha Mitchell Sci. Soc.* 98(4):218. 1982. Abstract only. SFA 30(2)

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[Dunstaffnage Mar. Res. Lab., Oban, Argyll, Scotland]

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[Dep. Fish. Oceans, Winnipeg, MB R3T 2N6, Canada]

85-001380 Brown, B. A. COMPARATIVE LIFE HISTORIES OF SOME SPECIES OF REDHORSE, SUBGENUS *MOXOSTOMA*, GENUS *MOXOSTOMA*. *Ph.D. dissertation, Indiana State Univ.* 84p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(9):2792. 1985. SFA 30(2)

85-001381 Cadigan, K. M. and P. E. Fell. REPRODUCTION, GROWTH AND FEEDING HABITS OF *MENIDIA MENIDIA* (ATHERINIDAE) IN A TIDAL MARSH-ESTUARINE SYSTEM IN SOUTHERN NEW ENGLAND. *Copeia* 1985(1):21-26. 1985. SFA 30(2)

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001381 CONTINUED
[Dep. Zool., Conn. Coll., New London 06320] The reproduction, growth and feeding habits of the Atlantic silverside, *Menidia menidia*, were studied in the Pataguanset River, a tidal marsh-estuarine system in eastern Connecticut. *Menidia menidia* was the second most abundant species in the system, next to *Fundulus heteroclitus*. Gonad indexes of both males and females were relatively high from the beginning of the study in early May until late July, indicating the silversides may breed over an extended period of time. Young-of-the-year were first caught in late June, although they were evidently present earlier. The large range in the size of the young suggested different hatching times. By October the number of *Menidia* caught was greatly reduced, apparently due, at least in part, to offshore movement by the fish. The major food items found in the guts of adult silversides were copepods, shrimp, small fish and plant material. Smaller fish fed more extensively on copepods and other zooplankton, while the larger silversides ingested larger amounts of shrimp and small fish. These observations document the importance of shallow tidal marsh-estuarine systems as spawning grounds and nursery areas for *Menidia menidia* and lend support to the growing body of evidence that suggests that this fish may represent an important vehicle for energy flow from tidal marsh-estuarine systems to open water.

85-001382 Crowe, B. J. DISTRIBUTION, LENGTH-WEIGHT RELATIONSHIP, AND LENGTH-FREQUENCY DATA OF SOUTHERN KINGFISH, *MENTICIRRHUS AMERICANUS*, IN MISSISSIPPI. *NOAA Fish. Bull.* 82(2):427-434. 1984. SFA 30(2)
[2021 W. Second St., Apt. 11-E, Long Beach, MS 39560]

85-001383 Cucin, D. and D. J. Faber. EARLY LIFE STUDIES OF LAKE WHITEFISH *(COREGONUS CLUPEAFORMIS)*, CISCO *(COREGONUS ARTEDII)* AND YELLOW PERCH *(PERCA FLAVESCENS)* IN LAKE OPEONGO, ONTARIO. *Ontario Fish. Tech. Rep. Ser.* No. 16. iii + 28p. 1985. SFA 30(2)
[Ontario Minist. Nat. Resour., Res. Sect., Fish. Br., Maple ON L0J 1E0, Canada] A program to study the early life stages of lake whitefish *(Coregonus clupeaformis)*, cisco *(Coregonus artedii)*, and yellow perch *(Perca flavescens)* was undertaken in Lake Opeongo, Ontario, between 1978 and 1980. Daytime surface tows in five index areas provided data on spatial and temporal distribution, and relative abundance and early growth. Additional morphological criteria to aid in the identification of larval cisco and whitefish were determined. Cisco larvae were more numerous and widespread than whitefish. Larval abundance of theses species varied among the index areas, but the best catches occurred over, or adjacent to, major spawning areas. Few larval coregonids were taken after surface temperatures attained 12°C. Lake whitefish and cisco emerged from spawning substrates at spring temperatures, which were almost identical to fall spawning temperatures. Perch were first taken in late May in the shallow littoral zones, and progressively later in limnetic areas up to 300-400 m from shore. Larval abundance and growth varied among index areas. A review of the reproduction and early life history of lake whitefish, cisco and yellow perch from Lake Opeongo and several other study areas is presented. Descriptions of the larval stages of four other species are also presented.

85-001384 Cummings, K. S.; J. M. Grady and B. M. Burr. THE LIFE HISTORY OF THE MUD DARTER, *ETHEOSTOMA ASPRIGENE*, IN LAKE CREEK, ILLINOIS. *Ill. Nat. Hist. Surv. Biol. Notes* No. 122. 16p. 1984. SFA 30(2)
[Ill. Nat. Hist. Surv., Champaign]

85-001385 Currin, B. M.; J. P. Reed and J. M. Miller. GROWTH, PRODUCTION, FOOD CONSUMPTION, AND MORTALITY OF JUVENILE SPOT AND CROAKER: A COMPARISON OF TIDAL AND NONTIDAL NURSERY AREAS. *Estuaries* 7(4A):451-459. 1984.

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001385 CONTINUED SFA 30(2)
[Dep. Zool., N. C. State Univ., Box 7617, Raleigh 27695-7617] As the dominant juvenile finfish in southeast and Gulf of Mexico nursery areas, spot and croaker growth, food consumption, production, and mortality are compared in tidal salt marshes and nontidal brackish systems. Growth rates of spot and croaker from 5 studies ranged from 0.021-0.04 g per g per d. Differences in the annual production and food consumption estimates were primarily due to differences in average biomass. Although mean biomass varied widely, the daily production to mean biomass ratios ranged from 0.021-0.037, suggesting that these systems probably could support more juvenile fish than are present. Spot mortality ranged from 0.023-0.041% per d. Despite large hydrographic differences between tidal and nontidal systems and large differences in the amount of detrital input, the secondary production values and many of the fish population parameters are remarkably similar. This is interpreted as confirmation of the basic trophic similarity of the different systems and the highly adaptable and general nature of juvenile fish. The primary consumers are supported by 50-100% of the algal production. But because the dominant fishes consume only 10-35% of that secondary production, at least in some systems, food does not appear to limit juvenile fish production. Predation on the juveniles is implicated as a limiting factor.

85-001386 Danie, D. S.; J. G. Trial and J. G. Stanley. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (NORTH ATLANTIC). ATLANTIC SALMON. *U.S. Fish Wildl. Serv.* FWS/OBS-82/11.22. vi + 19p. 1984. SFA 30(2)
[Me. Coop. Fish. Res. Unit, 313 Murray Hall, Univ. Me., Orono 04469]

85-001387 Gosline, W. A. STRUCTURE, FUNCTION, AND ECOLOGY IN THE GOATFISHES (FAMILY MULLIDAE). *Pac. Sci.* 38(4):312-323. 1984. SFA 30(2)
[Mus. Zool., Univ. Mich., Ann Arbor 48109]

85-001388 Gritsenko, C. F.; A. A. Churikov and S. S. Robionova. THE ECOLOGY OF THE POND SMELT, *HYPOMESUS OLIDUS* (OSMERIDAE), ON SAKHALIN. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):91-100. 1984. SFA 30(2)
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85-001389 Haegele, C. W. and J. F. Schweigert. DISTRIBUTION AND CHARACTERISTICS OF HERRING SPAWNING GROUNDS AND DESCRIPTION OF SPAWNING BEHAVIOR. *Can. J. Fish. Aquatic Sci.* 42(Suppl. 1):39-55. 1985. In English with French summ. SFA 30(2)
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[Cent. Excellence Mar. Biol., Univ. Karachi, Karachi, Pakistan]

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85-001392 Huehner, M. K.; M. E. Schramm and M. D. Hens. NOTES ON THE BEHAVIOR AND ECOLOGY OF THE KILLIFISH *RIVULUS MARMORATUS* POEY 1880 (CYPRINODONTIDAE). *Fla. Sci.* 48(1):1-7. 1985. SFA 30(2)
[Dep. Biol., Hiram Coll., Hiram, OH 44204]

85-001393 Hughes, G. W. THE COMPARATIVE ECOLOGY AND EVIDENCE FOR RESOURCE PARTITIONING IN TWO PHOLIDID FISHES (PISCES: PHOLIDIDAE) FROM SOUTHERN BRITISH COLUMBIA EELGRASS BEDS. *Can. J. Zool.* 63(1):76-85. 1985. In English with French summ. SFA 30(2)
[Aquatic Zool. Div., B.C. Prov. Mus., Victoria, BC V8V 1X4, Canada]

85-001394 Karpevich, A. F. and T. G. Lubimova. BIOLOGICAL BACKGROUND OF INTRODUCTION OF ANTARCTIC SPECIES OF FISH INTO ARCTIC SEAS OF THE USSR. *In: Marine Fish Farming. Collected Papers. All-Union Res. Inst. Mar. Fish. Oceanogr. (Moscow).* p. 8-26. 1984. In Russian with English summ. SFA 30(2)
[VNIRO, Moscow, USSR]

85-001395 Kawamula, H.; M. Mabuchi and T. Yonekawa. THE JAPANESE HUCHEN, *HUCHO PERRYI* (BREVOORT), COLLECTED IN BLACKISH WATER LAKE AKKESHI, EASTERN HOKKAIDO, JAPAN. *Sci. Rep. Hokkaido Fish Hatchery* No. 38. p. 47-55. 1983. In Japanese with English summ. SFA 30(2)
[Hokkaido Fish Hatchery, Nakanoshima, Toyohira-ku, Sapporo, Hokkaido, Japan]

85-001396 Konda Reddy, P. and T. J. Varghese. LIFE HISTORY OF A MAJOR CARP HYBRID ROHU-CATLA. *Indian J. Fish.* 30(1):87-95. 1983. SFA 30(2)
[Dep. Agric., Coll. Fish., Univ. Agric. Sci., Mangalore 575002, India] A hybrid, rohu-catla, was produced by crossing male rohu with female catla. The embryonic and larval developments of this hybrid, when compared with those of rohu and catla, showed that the development of the hybrid is normal, without any deformities, and is more or less similar to that of the parental species. The period of incubation in the hybrid was 15 h 42 min., as against 16 h 40 min. in catla and 15 h 30 min. in rohu. The hybrid exhibited intermediate characters in respect of the position of mouth and the nature of lips. The caudal spot in the hybrid was triangular as in catla, but more prominent. The alimentary canal in two-day-old larvae of the hybrid was filled with algae and cladocerans, indicating that feeding had commenced on the second day itself, with yolksac still present.

85-001397 Kupchinskiy, B. S. ECOMORPHOLOGICAL CHARACTERISTICS OF BREAM, *ABRAMIS BRAMA ORIENTALIS* (CYPRINIDAE), OF LAKE KOTOKEL' (TRANSBAIKAL REGION). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):101-107. 1984. SFA 30(2)
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85-001399 Mahadevan Pillai, P. K. ON THE BIOMETRY, FOOD AND FEEDING AND SPAWNING HABITS OF *OTOLITHES RUBER* (SCHNEIDER) FROM PORTO NOVO. *Indian J. Fish.* 30(1):69-73. 1983. SFA 30(2)
[Cent. Mar. Fish. Res. Inst., Cochin 682 018, India]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001400 Matheson, R. E., Jr. DESCRIPTION OF JUVENILES AND COMPARATIVE LIFE HISTORY NOTES FOR TWO COMMON FLORIDA MOJARRAS (PISCES: GERREIDAE). *Fla. Sci.* 48(suppl. 1):33. 1985. Abstract only. SFA 30(2)
[Harbor Br. Found., Inc., R.R. 1, Box 196-A, Fort Pierce, FL 33450]

85-001401 McMahon, T. E.; G. Gebhart; O. E. Maughan and P. C. Nelson. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: WARMOUTH. *U.S. Fish Wildl. Serv.* FWS/OBS-82/10.67. vi+21p. 1984. SFA 30(2)
[U.S. FWS, 2627 Redwing Rd., Fort Collins, CO 80526]

85-001402 Nagy, S. [ON THE AGE, GROWTH AND FOOD OF GRAYLING [*THYMALLUS THYMALLUS* (L.)] IN THE RIVER BELÁ [WESTERN TATRA MTS.].] *Prace Lab. Ryb. Hydrobiol.* 4:301-326. 1984. In Czech with English summ. SFA 30(2)
[Lab. Fisch. Hydrobiol., Drienova 3, 82624 Bratislava, Czechoslovakia]

85-001403 Narasimham, K. A. SOME OBSERVATIONS ON THE FISHERY AND BIOLOGY OF THE RIBBONFISH *EUPLEUROGRAMMUS GLOSSODON* (BLEEKER). *Indian J. Fish.* 30(2):269-277. 1983. SFA 30(2)
[Cent. Mar. Fish. Res. Inst. Cent., Kakinada 533002, India]

85-001404 Nwadiaro, C. S. THE DISTRIBUTION AND FOOD HABITS OF THE DWARF AFRICAN CICHLID, *PELVICACHROMIS PULCHER* IN THE RIVER SOMBREIRO, NIGERIA. *Hydrobiologia* 121(2):157-164. 1985. SFA 30(2)
[Hydrobiol./Fish. Unit, Dep. Zool., Univ. Port Harcourt, P.M.B. 5323, Port Harcourt, Nigeria]

85-001405 Overstreet, R. M. ASPECTS OF THE BIOLOGY OF THE SPOTTED SEATROUT, *CYNOSCION NEBULOSUS*, IN MISSISSIPPI. *Gulf Res. Rep.* Suppl. 1. p. 1-43. 1983. SFA 30(2)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

85-001406 Overstreet, R. M. ASPECTS OF THE BIOLOGY OF THE RED DRUM, *SCIAENOPS OCELLATUS*, IN MISSISSIPPI. *Gulf Res. Rep.* Suppl. 1. p. 45-68. 1983. SFA 30(2)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

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[Dep. Biol. Sci., Herbert H. Lehman Coll., Bronx, NY 10468]

85-001408 Pierce, B. E. CURRENT STATUS OF THE TROUTS ENDEMIC TO LAKE CRESCENT, WASHINGTON. *Proc. Olympic Wild Fish Conf.* p. 69-77. 1984. Proceedings available @ $15.00 from Dr. J. M. Walton, Peninsula Coll., 1502 E. Lauridsen Blvd., Port Angeles, WA 98362. SFA 30(2)
[Dep. Zool., Univ. Adelaide, Adelaide 5001, South Australia]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001409 Raleigh, R. F.; L. D. Zuckerman and P. C. Nelson. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: BROWN TROUT. *U.S. Fish Wildl. Serv.* FWS/OBS-82/10.71. viii + 71p. 1984. SFA 30(2)
[P.O. Box 625, Council, ID 83612]

85-001410 Robison, H. W. and G. L. Harp. DISTRIBUTION, HABITAT AND FOOD OF THE OUACHITA MADTOM, *NOTURUS LACHNERI*, A OUACHITA RIVER DRAINAGE ENDEMIC. *Copeia* 1985(1):216-220. 1985. SFA 30(2)
[Dep. Biol., South Ark. Univ., Magnolia 71753]

85-001411 Sheridan, P. F.; D. L. Trimm and B. M. Baker. REPRODUCTION AND FOOD HABITS OF SEVEN SPECIES OF NORTHERN GULF OF MEXICO FISHES. *Contrib. Mar. Sci.* 27:175-204. 1984. SFA 30(2)
[NMFS, 4700 Ave. U, Galveston, TX 77550]

85-001412 Sriramachandra Murty, V. OBSERVATIONS ON SOME ASPECTS OF BIOLOGY OF SILVERBELLY *LEIOGNATHUS BINDUS* (VALLENCIENNES) FROM KAKINADA. *Indian J. Fish.* 30(1):61-68. 1983. SFA 30(2)
[Kakinada Res. Cent., Cent. Mar. Fish. Res. Inst., Kakinada, India] The length-weight relationship of *Leiognathus bindus* can be described by the equation log W = -4.77709 + 2.96182 log L. The length at first maturity is estimated as 80 mm. This species is a fractional spawner and appears to release the ova in at least two spawning acts during the course of one year; it appears to spawn in almost all months, with a peak during December-February. Based on length-frequency distribution, the species attain 65 and 90 mm at the completion of first and second year respectively.

85-001413 Standard, G. W. and M. E. Chittenden, Jr. REPRODUCTION, MOVEMENTS, AND POPULATION DYNAMICS OF THE BANDED DRUM, *LARIMUS FASCIATUS*, IN THE GULF OF MEXICO. *NOAA Fish. Bull.* 82(2):337-363. 1984. SFA 30(2)
[Tex. Parks Wildl. Dep., Rt. 2, Box 537, Brownsville 78520] Collections of banded drum, *Larimus fasciatus*, were made from 5 to 100 m in the Gulf of Mexico along a cross-shelf transect off Texas during the period October 1977-August 1981. *Larimus fasciatus* mature at 80-130 mm as they approach age I. Spawning occurs during two discrete periods, a major fall period (September-November) and a very minor spring period (April-June), coincident with downcoast alongshore currents (toward Mexico) and onshore surface Ekman transport. Fish first spawning at 12-14 months old produce the predominant fall-spawned groups. Fall-spawned fish spawning at 19-21 months old produce the minor spring-spawned groups, so that temporal reproductive isolation does not exist between spring and fall cohorts. *Larimus fasciatus* in the northwestern Gulf range from <5 to 55 m but are most abundant at 5-16 m. Adults occupy the 13-24 m bathymetric range, while the young recruit in waters of <5-16 m when 2-4 months old. Larger, older, spawning or postspawning individuals may undergo more or less permanent emigration from the northwestern Gulf to the north central area as they approach age I. Apparent mean sizes of fall-spawned fish were 130-150 mm at age I and 155-180 mm at or approaching age II. Von Bertalanffy parameters for fall-spawned fish were 201 and 176 mm for L_∞ and 1.15 and 1.34 for K (annual), respectively. Maximum size is about 180 mm in the northwestern Gulf, but more typically only 160-165 mm. Typical maximum life span (t_L) in the northwestern Gulf is only 1-2 years but may be 2-3 years if the stock ranges in both the northwestern and north central Gulf. Apparent mean time-specific and cohort-specific total annual mortality rates are 92-100% in the northwestern Gulf but true values probably are 80-90% for a stock that ranges in both the northwestern and north central Gulf. Fecundity, weight, girth, and length relationships are presented.

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001414 Targett, T. E. A BREEDING POPULATION OF GULF PIPEFISH *(SYNGNATHUS SCOVELLI)* IN A GEORGIA ESTUARY, WITH DISCUSSION ON THE ECOLOGY OF THE SPECIES. *Contrib. Mar. Sci.* 27:169-174. 1984. SFA 30(2)
[Univ. Del., Coll. Mar. Sci., Lewes 19958] Thirty-four gulf pipefish *(Syngnathus scovelli)* were captured in the Ossabaw Sound/Ogeechee River estuary on the northern portion of the Georgia coastline, 165 km north of the previously described geographical range. Continued capture of gulf pipefish in this estuary over a period of 20 months, the spatial extent of their occurrence, the presence of juveniles, and the presence of males brooding embryos all indicate an established, breeding population. All specimens were collected in intertidal creeks that drain *Spartina* and *Juncus* salt marsh at the fringe of the estuary. The absence of seagrasses, with which this species is closely associated throughout its range, does not exclude the species from inhabiting the salt marsh creek environment. Winter temperatures are colder than in other parts of its range. Water temperatures as low as 5°C and remaining < 10°C from early January through mid-February are within the tolerance range of this species. Dorsal fin ray frequency is substantially greater in the Georgia population than elsewhere in its geographical range. Unusually large males occur in this population, and the sex ratio appears to be heavily skewed toward females.

85-001415 Troutman, H. LIFE HISTORY ASPECTS OF THE TAUTOG AT THE MASONBORO INLET JETTIES, WRIGHTSVILLE BEACH, NC. *J. Elisha Mitchell Sci. Soc.* 98(4):219. 1982. Abstract only. SFA 30(2)

85-001416 Twomey, K. A.; K. L. Williamson and P. C. Nelson. HABITAT SUITABILITY INDEX MODELS AND INSTREAM FLOW SUITABILITY CURVES: WHITE SUCKER. *U.S. Fish Wildl. Serv.* FWS/OBS-82/10.64. viii + 56p. 1984. SFA 30(2)
[Wyo. Coop. Fish. Res. Unit, Univ. Wyo., Laramie 82071]

85-001417 Van Den Avyle, M. J. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (SOUTH ATLANTIC). ATLANTIC STURGEON. *U.S. Fish Wildl. Serv.* FWS/OBS-82/11.25. vi + 17p. 1984. SFA 30(2)
[Ga. Coop. Fish. Res. Unit, Sch. For. Resour., Univ. Ga., Athens 30602]

85-001418 Van Den Avyle, M. J. SPECIES PROFILES: LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS OF COASTAL FISHES AND INVERTEBRATES (SOUTH ATLANTIC). AMERICAL EEL. *U.S. Fish Wildl. Serv.* FWS/OBS-82/11.24. vi + 19p. 1984. SFA 30(2)
[Ga. Coop. Fish Res. Unit., Sch. For. Resour., Univ. Ga., Athens 30602]

85-001419 Van der Elst, R. and B. B. Collette. GAME FISHES OF THE EAST COAST OF SOUTHERN AFRICA. 2. BIOLOGY AND SYSTEMATICS OF THE QUEEN MACKEREL *SCOMBEROMORUS PLURILINEATUS. S. Afr. Assoc. Mar. Biol. Res. Oceanogr. Res. Inst. Invest. Rep.* No. 55. 12p. 1984. SFA 30(2)
[Oceanogr. Res. Inst., P.O. Box 10712, Marine Parade, Durban, 4056, South Africa]

85-001420 Ware, D. M. LIFE HISTORY CHARACTERISTICS, REPRODUCTIVE VALUE, AND RESILIENCE OF PACIFIC HERRING *(CLUPEA HARENGUS PALLASI). Can. J. Fish. Aquatic Sci.* 42(Suppl. 1):127-137. 1985. In English with French summ. SFA 30(2)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

LIFE HISTORY-GENERAL WORKS (CONTINUED)

85-001421 Weber, J. J. and K. J. Otis. LIFE HISTORY OF CARP IN THE LAKE WINNEBAGO SYSTEM, WISCONSIN. *Wis. Dep. Nat. Resour. Res. Rep.* No. 131. 27p. 1984. SFA 30(2)

[Wis. Dep. Nat. Resour., Bur. Res., Oshkosh] Carp (*Cyprinus carpio* Linnaeus) life history information was compiled from observations and collections made on Lakes Winnebago, Butte des Morts, Poygan, and Winneconne. Previously, lack of information on carp populations and ecology in these lakes has limited the development of management strategies for this species. Methods and techniques are discussed for sampling of eggs, young-of-the-year, and adult carp. Adult carp were aged from cross-sections of the dorsal spine because of undefinitive annuli on scales and opercles. Carp spawned in shallow vegetated habitats. The adhesive eggs hatched in 3-4 days, and the 5-mm larvae immediatedly became demersal. After about 3 days, the yolk sacs were absorbed and fry became mobile. Throughout their first summer, carp were found in vegetated cover. Ranges in size distribution of age 0 carp indicated that extended spawning seasons were favorable to young-of-the-year recruitment. Young carp ate predominantly copepods, dipterans, and cladocerans; they ate almost no plant material. The mean female gonodosomatic index was 16.2%. Carp growth in all 4 lakes was better than average compared to other waters, and males and females commonly reached age XV. Female carp had greater longevity, slightly better growth, and higher condition factors than males.

85-001422 Whiteside, M. C.; C. M. Swindoll and W. L. Doolittle. FACTORS AFFECTING THE EARLY LIFE HISTORY OF YELLOW PERCH, *PERCA FLAVESCENS*. *Environ. Biol. Fishes* 12(1):47-56. 1985. SFA 30(2)

[Dep. Zool., Univ. Tenn., Knoxville 37996-0810] From 1979 to 1981 we followed the movement, diet, and growth of yellow perch, *Perca flavescens*, for their first 70 days after hatching in Lake Itasca, Minnesota. Perch spawned inshore during early spring: hatching occurred 10-20 days after spawning. Newly hatched perch were 5.6-6.2mm total length (TL). Soon after hatching the larvae moved into the limnetic zone where they began feeding. This movement is probably a mechanism to escape intense predation in the littoral zone. Normally the first food of perch was immature copepods, but within a week they incorporated all common zooplankters into their diet. When the perch reached 25mm TL (about day 40) they returned to the littoral zone, where they ate larger and more abundant prey than was present in the limnetic habitat. There is no correlation between growth rates and zooplankton abundances, which suggests that food quantity is not a limiting factor in the early life history of perch in Lake Itasca.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC.

85-001423 Beckley, L. E. TIDE-POOL FISHES: RECOLONIZATION AFTER EXPERIMENTAL ELIMINATION. *J. Exp. Mar. Biol. Ecol.* 85(3):287-295. 1985. SFA 30(2)

[Zool. Dep., Univ. Cape Town, Rondebosch 7700, South Africa] Recolonization of tide-pools by fishes, after periodic rotenone poisoning, was examined over 2 yr in the East Cape, South Africa. Rapid recolonization occurred with species of Clinidae, Gobiidae, Sparidae and Cheilodactylidae constituting the bulk of the recolonizers. There tended to be lower densities of recolonizers in winter than in summer. The summer recruitment of juvenile *Clinus superciliosus* (L.), *Clinus cottoides* (Valenciennes) and *Diplodus sargus* (L.), strongly influenced this seasonal pattern. Repopulation of pools was not exclusively by juvenile recruits and it is suggested that the larger recolonizers were fishes from adjacent pools whose home ranges overlapped with the study areas.

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

85-001424 Bergander, F. ANALYSIS OF LYNN CANAL SOCKEYE SALMON (*ONCORYHNCHUS NERKA*) BROOD YEAR RETURNS, 1976 THROUGH 1982. *Alaska Dep. Fish Game Inf. Leafl.* No. 245. iii + 19p. 1985. SFA 30(2)
[Alaska Dep. Fish Game, Div. Commer. Fish., Juneau 99802]

85-001425 Bielak, A. T. QUEBEC NORTH SHORE ATLANTIC SALMON STOCKS. *Ph.D. dissertation, Univ. Waterloo (Canada)* 1984. From Diss. Abstr. Int. B Sci. Eng. 45(10):3153. 1985. SFA 30(2)

85-001426 Boreman, J. and H. M. Austin. PRODUCTION AND HARVEST OF ANADROMOUS STRIPED BASS STOCKS ALONG THE ATLANTIC COAST. *Trans. Am. Fish. Soc.* 114(1):3-7. 1985. SFA 30(2)
[NMFS, Woods Hole Lab., Woods Hole, MA 02543]

85-001427 Burd, A. C. RECENT CHANGES IN THE CENTRAL AND SOUTHERN NORTH SEA HERRING STOCKS. *Can. J. Fish. Aquatic Sci.* 42(Suppl. 1):192-206. 1985. In English with French summ. SFA 30(2)
[Fish. Lab., Lowestoft, Suffolk NR33 OHT, England]

85-001428 Caswell, H.; R. J. Naiman and R. Morin. EVALUATING THE CONSEQUENCES OF REPRODUCTION IN COMPLEX SALMONID LIFE CYCLES. *Aquaculture* 43(1-3):123-134. 1984. SFA 30(2)
[Biol. Dep., Woods Hole Oceanogr. Inst., Woods Hole, MA 02543]

85-001429 Clark, E.; P. Pemberton and R. Leen. POPULATION DENSITY OF A COLONY OF BLUESPOTTED JAWFISH OFF BAJA CALIFORNIA. *Underwater Nat.* 15(2):3-7. 1985. SFA 30(2)
[Dep. Zool., Univ. Md., College Park]

85-001430 Colvocoresses, J. A. and J. A. Musick. SPECIES ASSOCIATIONS AND COMMUNITY COMPOSITION OF MIDDLE ATLANTIC BIGHT CONTINENTAL SHELF DEMERSAL FISHES. *NOAA Fish. Bull.* 82(2):295-313. 1984. SFA 30(2)
[Va. Inst. Mar. Sci., Coll. William and Mary, Gloucester Point, VA 23062]

85-001431 Goodyear, C. P. RELATIONSHIP BETWEEN REPORTED COMMERCIAL LANDINGS AND ABUNDANCE OF YOUNG STRIPED BASS IN CHESAPEAKE BAY, MARYLAND. *Trans. Am. Fish. Soc.* 114(1):92-96. 1985. SFA 30(2)
[U.S. FWS, Box 700, Kearneysville, WV 25430]

85-001432 Goodyear, C. P.; J. E. Cohen and S. W. Christensen. MARYLAND STRIPED BASS: RECRUITMENT DECLINING BELOW REPLACEMENT. *Trans. Am. Fish. Soc.* 114(1):146-151. 1985. SFA 30(2)
[U.S. FWS, Box 700, Kearneysville, WV 25430]

85-001433 Haegele, C. W. and J. F. Schweigert. ESTIMATION OF EGG NUMBERS IN PACIFIC HERRING SPAWNS ON GIANT KELP. *N. Am. J. Fish. Manage.* 5(1):65-71. 1985. SFA 30(2)
[Pac. Biol. Stn., Nanaimo, BC V9R 5K6, Canada]

85-001434 Hoff, M. H. and S. L. Serns. CHANGES IN THE HARVEST, MEAN SIZE-AT-AGE, LENGTH-WEIGHT RELATIONSHIP AND CONDITION OF CISCO IN PALLETTE LAKE, 1946-1980. *Wis. Dep. Nat. Resour. Res. Rep.* 122. 11p. 1983. Available from Wis. Dep. Nat. Resour., Madison. SFA 30(2)
Data on the harvest, mean size-at-age, length-weight relationship and condition of Pallette Lake cisco (*Coregonus artedii*) were analyzed for

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

85-001434 CONTINUED selected years between 1946 and 1980. Changes in these parameters were examined with respect to the great reduction in harvest after the access road to Pallette Lake was closed to motor vehicles in 1968. A 23-fold reduction in annual cisco harvest (number) and 33-fold reduction in annual yield (lb) occurred during 1969-1980, as compared to annual cisco harvest and yield from 1946-1968 when motor vehicles had access to the lakeshore. Mean lengths of cisco age groups were substantially lower in the years sampled after access road closure, particularly after the second year of life. Walford plots of length increase indicated that asymptotic length (L^{∞}) was greatest in the 1950's (10.6 inches), and lower in the 1960's (10.1 inches), 1947 (9.7 inches), and 1979-1980 (9.4 inches). Ford's growth coefficients (k) demonstrated that the rate with which asymptotic length was attained was highest in the 1950's (k = 1.0297), followed by the 1960's (k = 1.0281), 1979-1980 (k = 0.9163), and 1947 (k = 0.5108). In all decades, increases in mean size-at-age were greatest during the first two year of life. The greatest increases in weight per unit length of cisco from the four decades sampled were found in the 1950's and 1940's, when weight increased by more than the cube of the length. Cisco weight increased by slightly less than the cube of the length in the 1960's and by less than the square of the length in the 1979-1980 samples. Mean weight-at-age was substantially lower after the second year of life for cisco in the 1979 and 1980 samples compared to cisco from the decades sampled prior to access closure. Generally, mean length and weight-at-age of Pallette Lake cisco were markedly greater before access limitation severely limited harvest. T-tests revealed significantly lower ($p<0.001$) mean condition factors of 7.0- to 7.9-inch cisco and 8.0- to 8.9-inch cisco after the access road was closed. Linear regression analyses revealed that as harvest (number) and yield (lb) increased the mean condition factors of cisco would also increase two to three years later. Mean condition factors increased more abruptly as yield increased than as harvest increased in the two and three previous years, and the mean condition factors increased somewhat more sharply as both harvest and yield increased in the two previous years than in the three previous years. Samples of Pallette Lake cisco were dominated more by males than any other spawning ground surveys noted in the literature, although the percentage of females did increase with increased age.

85-001435 Jensen J. M. and W. H. Lear. ATLANTIC SALMON CAUGHT IN THE IRMINGER SEA AND AT EAST GREENLAND. *J. Northwest Atl. Fish. Sci.* 1:55-64. 1980. SFA 30(2)
[Grønlands Fiskeriunders., DK 2920 Charlottenlund, Denmark]

85-001436 Jensen, A. L. RELATIONS AMONG NET REPRODUCTIVE RATE AND LIFE HISTORY PARAMETERS FOR LAKE WHITEFISH *(COREGONUS CLUPEAFORMIS). Can. J. Fish. Aquatic Sci.* 42(1):164-168. 1985. In English with French summ. SFA 30(2)
[Sch. Nat. Resour., Univ. Mich., Ann Arbor 48109-1115]

85-001437 Johnson, T. H. SETTING SPAWNER ESCAPEMENT GOALS FOR WILD STEELHEAD POPULATIONS. *Proc. Olympic Wild Fish Conf.* p. 269-275. 1984. Proceedings available @ $15.00 from Dr. J. M. Walton, Peninsula Coll., 1502 E. Lauridsen Blvd., Port Angeles, Wa 98362] SFA 30(2)
[Wash. State Dep. Game, Snow Creek Res. Stn., 8594 Highway 101, Port Townsend 98368]

85-001438 Kimura, D. K. and J. W. Balsiger. BOOTSTRAP METHODS FOR EVALUATING SABLEFISH POT INDEX SURVEYS. *N. Am. J. Fish. Manage.* 5(1):47-56. 1985. SFA 30(2)
[NMFS, Bin C15700, 7600 Sandpoint Way N.F., Seattle, WA 98115]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

85-001439 Mankin, P. C.; P. R. Beaty; W. F. Childers and D. P. Philipp. RELATIONSHIP BETWEEN POPULATION DENSITY OF ADULT NORTHERN LARGEMOUTH BASS, *MICROPTERUS SALMOIDES SALMOIDES*, AND POND PRODUCTION OF YOUNG-OF-THE-YEAR. *Trans. Ill. State Acad. Sci.* 77(3-4):179-185. 1984. SFA 30(2)
[Univ. Ill., 111C Vivarium, Urbana 61801] Adult largemouth bass were stocked into three 0.08-hectare experimental ponds at three different densities (50, 150 or 300 individuals per hectare). The number of offspring censused in the low, moderate and high density ponds were 79,288, 58,863 and 17,413 per hectare, respectively. The data indicate a negative relationship between the density of adults stocked and the number of juvenile largemouth bass produced.

85-001440 Mann, R. H. K.; J. M. Hellawell; W. R. C. Beaumont and G. I. Williams. RECORDS FROM THE AUTOMATIC FISH COUNTER ON THE RIVER FROME, DORSET 1970-1981. *Freshwater Biol. Assoc. Occas. Publ.* No. 19. 100p. 1983. SFA 30(2)
[Freshwater Biol. Assoc., Ambleside, Cumbria LA22 OLP, England]

85-001441 Martin, D. J. GROWTH, FOOD CONSUMPTION, AND PRODUCTION OF CUTTHROAT TROUT IN RELATION TO FOOD SUPPLY AND WATER TEMPERATURE. *Proc. Olympic Wild Fish Conf.* p. 135-144. 1984. Proceedings available @ $15.00 from Dr. J. M. Walton, Peninsula Coll., 1502 E. Lauridsen Blvd., Port Angeles, WA 98362. SFA 30(2)
[Fish. Res. Inst., WH-10, Univ. Wash., Seattle 98195] Growth, food consumption, and production of a wild cutthroat trout population in relation to food supply (terrestrial and aquatic) and water temperature was investigated in Bear Creek, a tributary of the Bogachiel River, Olympic Peninsula, Washington in 1978. Trout growth rate declined from a spring high to a low in the winter, and was below the maximum possible during periods of optimum water temperature. Food consumption by the population followed the seasonal trend in food abundance and was limited by the available food supply. Food availability, hence consumption by an age group, was a function of fish size. All fish preferred aquatic organism over terrestrial organisms, but the latter was an important component in the diet during the summer low flow period. Food consumption rate limits growth rate, therefore, growth rate is limited by the available food supply. The implication of food limitation on growth is manifested through the control of population production.

85-001442 Mironovsky, L. N. [ON THE POPULATION STRUCTURE OF THE BREAM (*ABRAMIS BRAMA*).] *Zool. Zh.* 64(2):307-311. 1985. In Russian with English summ. SFA 30(2)
[Inst. Biol. Inland Waters, USSR Acad. Sci., Borok, Yaroslavl Dist., USSR]

85-001443 Murty, V. S. ESTIMATES OF MORTALITY, POPULATION SIZE AND YIELD PER RECRUIT OF *NEMIPTERUS JAPONICUS* (BLOCH) IN THE TRAWLING GROUNDS OFF KAKINADA. *Indian J. Fish.* 30(2):255-260. 1983. SFA 30(2)
[Cent. Mar. Fish. Res. Inst. R.C., Kakinada, India]

85-001444 Narasimham, K. A. ON FISHERY, MORTALITY RATES AND YIELD PER RECRUIT OF RIBBONFISH *TRICHIURUS LEPTURUS* LINNAEUS. *Indian J. Fish.* 30(1):99-109. 1983. SFA 30(2)
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85-001445 Newrkla, P. and A. Duncan. THE BIOLOGY AND DENSITY OF *EHIRAVA FLUVIATILIS* (CLUPEOID) IN PARAKRAMA SAMUDRA, SRI LANKA. *Int. Ver. Theor. Agnew. Limnol. Verh.* 22(Part 3):1572-1578. 1984. SFA 30(2)

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85-001446 Pawson, M. G. and M. S. Giama. A BIOLOGICAL SAMPLING PROBLEM ILLUSTRATED BY THE POPULATION STRUCTURE AND GROWTH PATTERNS OF *SARDINELLA AURITA* AT TRIPOLI, LIBYA. *Environ. Biol. Fishes* 12(2):143-154. 1985. SFA 30(2)
[Fish. Lab., Lowestoft, Suffolk NR33 0OT, England]

85-001447 Pillai, C. S. G.; M. Mohan and K. K. Kunhikoya. ON AN UNUSUAL MASSIVE RECRUITMENT OF THE REEF FISH *CTENOCHAETES STRIGOSUS* (BENNET) (PERCIFORMES: ACANTHURIDAE) TO THE MINICOY ATOLL AND ITS SIGNIFICANCE. *Indian J. Fish.* 30(2):261-268. 1983. SFA 30(2)
[Cent. Mar. Fish. Res. Inst. Cent., Minicoy, U.T. Lakshadweep, India]

85-001448 Reddin, D. G. and R. K. Misra. HOTELLING'S T^2 TO IDENTIFY THE ORIGIN OF ATLANTIC SALMON (*SALMO SALAR*) IN A MIXED-STOCK FISHERY. *Can. J. Fish. Aquatic Sci.* 42(2):250-255. 1985. In English with French summ. SFA 30(2)
[Dep. Fish. Oceans, Fish. Res. Br., P.O. Box 5667, St. John's, NF A1C 5X1, Canada]

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[Cent. Limnol., Univ. Wis., Madison]

85-001451 Sánchez, R. P. and J. D. de Ciechomski. [ASSESSMENT OF THE BIOMASS OF ADULT SPAWNERS OF THE ANCHOVY (*ENGRAULIS ANCHOITA*) IN THE COASTAL REGION OFF BUENOS AIRES PROVINCE IN SPRING, 1981 AND COMPARATIVE ANALYSIS OF THE COUNTS OF ICHTHYOPLANKTON COLLECTED WITH DIFFERENT MESH SIZES.] *Rev. Invest. Desarr. Pesq.* No. 4. p. 49-61. 1984. In Spanish with English summ. SFA 30(2)
[INIDEP, Mar del Plata, Argentina]

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[Biol. Stn., St. Andrews, NB E0G 2X0, Canada]

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[Biologo-Soil Inst., Far East. Res. Cent., USSR Acad. Sci., Vladivostok, USSR]

POPULATION STUDIES, PRODUCTION, RECRUITMENT, ETC. (CONTINUED)

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[NMFS, La Jolla, CA 92038]

85-001455 Stocker, M.; V. Haist and D. Fournier. ENVIRONMENTAL VARIATION AND RECRUITMENT OF PACIFIC HERRING *(CLUPEA HARENGUS PALLASI)* IN THE STRAIT OF GEORGIA. *Can. J. Fish. Aquatic Sci.* 42(Suppl. 1):174-180. 1985. In English with French summ. SFA 30(2)
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85-001456 Sukumaran, K. K. SOME OBSERVATIONS ON THE FISHERY AND BIOLOGY OF *NEMATOPALAEMON TENUIPES* (HENDERSON) AT BOMBAY. *Indian J. Fish.* 30(2):306-313. 1983. SFA 30(2)
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85-001457 Vasil'kov, V. P. and S. Y. Glebova. FACTORS DETERMINING YEAR-CLASS STRENGTH OF THE WALLEYE POLLOCK, *THERAGRA CHALCOGRAMMA* (GADIDAE), OF WESTERN KAMCHATKA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):80-90. 1984. SFA 30(2)
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SPAWNING HABITS AND MOVEMENTS, FECUNDITY, ETC.

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85-001522 Carter, H. J. FEEDING STRATEGIES AND FUNCTIONAL MORPHOLOGY OF DEMERSAL DEEP-SEA OPHIDIID FISHES. *Ph.D. dissertation, Coll. William and Mary in Va.* 250p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(10):3177. 1985. SFA 30(2)

FOODS/FEEDING (CONTINUED)

85-001523 Coetzee, D. J. and R. C. Pool. STOMACH CONTENT ANALYSIS OF THE SEA BARBEL, *GALEICHTHYES FELICEPS* (VALENCIENNES IN C & V), FROM THE SWARTVLEI SYSTEM, SOUTHERN CAPE. *S. Afr. J. Zool.* 20(1):33-37. 1985.
[Cape Dep. Nat. Environ. Conserv., Jonkershoek Nat. Conserv. Stn., P.B. 5014, Stellenbosch, 7600 South Africa] The diet of the sea barbel, *Galeichthyes feliceps*, in the Swartvlei estuarine system was investigated during the period April 1979 to March 1980. The stomachs of 393 specimens (TL 13.5 to 46.0 cm) were examined. The sea barbel appears to be a bottom feeder with the crown crab, *Hymenosoma orbiculare*, forming its main prey throughout the system. Unidentified pieces of fish and the tube-dwelling amphipod, *Grandidierella lignorum*, were respectively the second and third most important food items. The feeding habits of most adult male sea barbel were markedly affected by the breeding season, since during this time they were carrying developing eggs in their mouths and apparently did not feed.

85-001524 Crabtree, R. E. FOOD HABITS AND BODY COMPOSITION OF SOME DOMINANT DEEP-SEA FISHES FROM TEMPERATE AND TROPICAL REGIONS OF THE WESTERN NORTH ATLANTIC. *Ph.D. dissertation, Coll. William and Mary in Va.* 171p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(9):2774. 1985. SFA 30(2)

85-001525 Crowder, L. B. OPTIMAL FORAGING AND FEEDING MODE SHIFTS IN FISHES. *Environ. Biol. Fishes* 12(1):57-62. 1985. SFA 30(2)
[Dep. Zool., N. C. State Univ., Campus Box 7617, Raleigh 27695-7617]

85-001526 Culver, D. A.; R. M. Vaga and C. S. Munch. EFFECT OF SIZE-SELECTIVE FISH PREDATION ON THE REPRODUCTIVE OUTPUT OF CLADOCERA IN HATCHERY PONDS. *Int. Ver. Theor. Agnew. Limnol. Verh.* 22(Part 3):1636-1639. 1984. SFA 30(2)
[Dep. Zool., Ohio State Univ., 1735 Neil Ave., Columbus, OH 43210]

85-001527 Datta, N. C. and M. Das. OBSERVATION ON THE FOOD AND FEEDING HABITS OF SOME FLATFISHES OF ORISSA COAST. *Indian J. Fish.* 30(2):241-248. 1983. SFA 30(2)
[Dep. Zool., Univ. Calcutta, Calcutta 700019, India]

85-001528 Dill, L. M. and A. H. G. Fraser. RISK OF PREDATION AND THE FEEDING BEHAVIOR OF JUVENILE COHO SALMON (*ONCORHYNCHUS KISUTCH*). *Behav. Ecol. Sociobiol.* 16(1):65-71. 1984. SFA 30(2)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada] During their first 1-2 years of life, juvenile coho salmon (*Oncorhynchus kisutch*) are stream-dwelling, and feed upon drifting invertebrates. They move upstream from a holding position to intercept individual prey items; the distance moved (attack distance) is an increasing, but decelerating, function of prey size. Since the fish are presumably more visible to predators during such feeding excursions, prey size and risk are associated variables. The effect on attack distance of the presentation of a model predator (a photograph of a rainbow trout) was examined in the laboratory. Attack distances are shortened following presentation of a predator; this is particularly true when the prey are large. The extent of the reduction of attack distance is directly related to predator presentation frequency, although there appears to be a minimum level to which it will decline. Hungry fish and fish in the presence of a competitor (simulated by a mirror) are less responsive to the predator, suggesting a trade-off of energetic requirements and risk . The effect of predation risk should be to reduce the relative proportion of large prey in a juvenile coho's diet, and its net rate of energy intake.

FOODS/FEEDING (CONTINUED)

85-001529 Fyfe, J. TROPHIC VARIATIONS IN SALT MARSH FISHES. *Fla. Sci.* 48(suppl. 1):28. 1985. Abstract only. SFA 30(2)
[Harbor Br. Found., Inc., R.R. 1, Box 196, Ft. Pierce, FL 33450] The gut contents of the sheepshead minnow *Cyprinodon variegatus*, mosquitofish *Gambusia affinis*, sailfin molly *Poecilia latipinna*, striped mullet *Mugil cephalus*, white mullet *Mugil curema* and ladyfish *Elops saurus* were examined from specimens collected in a tidally influenced impounded subtropical marsh and adjacent estuary. Intraspecific comparisons of fishes collected from upper, lower marsh and estuarine habitats revealed spatial and temporal variations in diet for these species. Mollies, mullet and sheepshead minnows consumed principally detrital algal conglomerates and exhibited no major ontogenetic shift in diet. An ontogenetic shift was seen in *E. saurus* and *G. affinis*, both preying predominantly on copepods as juveniles. At standard lengths of 20 mm in *G. affinis* and 35 mm in *E. saurus* amphipods and insects became major food items. Ladyfish larger than 55 mm SL consumed fishes, crustaceans and insects. These data reveal a significant qualitative and quantitative dietary succession for the same species when compared to historical preimpoundment studies conducted at the same location.

85-001530 Gaudin, P. and M. Heland. [INFLUENCE OF SCULPIN ADULTS *(COTTUS GOBIO* L.) ON BROWN TROUT (*SALMO TRUTTA* L.) FRY: EXPERIMENTAL STUDY IN SEMI-NATURAL ENVIRONMENTS.] *Acta Oecol. Oecol. Appl.* 5(1):71-83. 1984. In French with English summ. SFA 30(2)
[Dep. Biol. Anim. Ecol., Univ. Claude-Bernard, Lyon I, 43, boulevard du 11-Novembre-1918, 69622 Villeurbanne Cedex, France]

85-001531 Goldschmid, A.; K. Kotrschal and P. Wirtz. FOOD AND GUT LENGTH OF 14 ADRIATIC BLENIID FISH (BLENNIIDAE; PERCOMORPHA; TELEOSTEI). *Zool. Anz.* 213(3-4):145-150. 1984. SFA 30(2)
[Zool. Inst., Univ. Salzburg, Austria]

85-001532 Hallacher, L. E. and D. A. Roberts. DIFFERNETIAL UTILIZATION OF SPACE AND FOOD BY THE INSHORE ROCKFISHES (SCORPAENIDAE: *SEBASTES*) OF CARMEL BAY, CALIFORNIA. *Environ. Biol. Fishes* 12(2):91-110. 1985. SFA 30(2)
[Dep. Biol., Univ. Hawaii, Hilo 96720]

85-001533 Hargrave, B. T.; G. C. Harding; K. F. Drinkwater; T. C. Lambert and W. G. Harrison. DYNAMICS OF THE PELAGIC FOOD WEB IN ST. GEORGES BAY, SOUTHERN GULF OF ST. LAWRENCE. *Mar. Ecol. Prog. Ser.* 20(3):221-240. 1985. SFA 30(2)
[Mar. Ecol. Lab., Bedford Inst. Oceanogr., P.O. Box 1006, Dartmouth, NS B2Y 4A2, Canada]

85-001534 Hoekstra, D. and J. Janssen. NON-VISUAL FEEDING BEHAVIOR OF THE MOTTLED SCULPIN, *COTTUS BAIRDI*, IN LAKE MICHIGAN. *Environ. Biol. Fishes* 12(2):111-117. 1985. SFA 30(2)
[Biol. Dep., Loyola Univ., 6525 N. Sheridan Rd., Chicago, IL 60626] Field and laboratory experiments indicate that the mottled sculpin, *Cottus bairdi*, feed in the dark. Blinded sculpins feed on a variety of motile prey in the laboratory and show sterotyped responses to prey stimuli. The sculpins bite at moving inert objects, even if buried in substratum, indicating that they use their lateral line system to detect prey. Covering portions of the lateral line with an inert paste eliminates response to objects near the covered region of the lateral line. The sculpins can also detect prey (including inert objects) in a stream if the prey is upstream. Collection from two series of presunset, postsunset, presunrise, postsunrise, dives in Lake Michigan indicate nocturnal feeding by the mottled sculpin.

FOODS/FEEDING (CONTINUED)

85-001535 Holm, J. C. and D. Moller. GROWTH AND PREY SELECTION BY ATLANTIC SALMON YEARLINGS REARED ON LIVE FRESHWATER ZOOPLANKTON. *Aquaculture* 43(4):401-412. 1984. SFA 30(2)

[Inst. Fish. Biol., Univ. Bergen, N-5011 Nordnes, Norway] The experiment was carried out in a coastal lake near Bergen, Norway. Two experimental groups of Atlantic salmon *(Salmo salar)* yearlings were fed with live zooplankton in an artificial current. A third group, given commercial dry food pellets, was used as a control. The offered zooplankton biomass reached a maximum in the second week of July. The cladoceran *Daphnia longispina* dominated the zooplankton at this moment. A stock breakdown for this species was soon observed. The salmon yearlings preferred cladocerans. At the height of the zooplankton occurrence, *Daphnia* became the only prey species observed in the stomachs--and a prey selection for larger individuals was observed when food was in surplus. Earlier in the period the salmon selected the largest individuals of two cladoceran species of different shape, pigmentation and size at the same time. In the experiment live zooplankton was recognised as a satisfactory food when it occurred in sufficient amounts, compared with commercial fry food pellets. Best mean growth rate of zooplankton-fed fish was 0.92 mm/day. Negative growth rate was observed when low zooplankton densities occurred.

85-001536 Hunt, R. L. and K. W. Niermeyer. FOOD HABITS OF BROOK TROUT IN McGEE LAKE, 1980-82. *Wis. Dep. Nat. Resour. Res. Rep.* 125. 11p. 1984. Available from Wis. Dep. Nat. Resour., Madison. SFA 30(2)

Excellent growth of brook trout (*Salvelinus fontinalis*) in 23-acre McGee Lake was attributed to their predominantly piscivorous diet. Piscivory in this lake began at a much smaller size than is typical for salmonids. Stocking brook sticklebacks to supplement food resources for brook trout should be considered as a management option for other lakes and ponds. These conclusions were based on analyses of food habits of 745 brook trout collected during 1980-82. Length range of these trout was 3.0-18.9 inches. Trout caught by anglers during May-September provided 642 of these stomachs. Nearly all of these trout were domestic in origin, stocked as yearlings each April. The remaining 103 stomachs were from 3- to 6-inch trout collected with electrofishing gear in April and early October. Nearly all of these were wild age 0 or age 1. Forage fish, either sticklebacks (*Culaea inconstans*) or fathead minnows (*Pimephales promelas*), were the dominant food by volume, accounting for 51% of the total. They were present in 44% of all stomachs. Diptera (primarily Chronomidae) ranked second by volume (23%), but first by frequency of occurrence (57%). Forage fish were important in brook trout diets throughout the size range sampled, including trout as small as 3-5 inches (35% of 68 stomachs in that size range contained forage fish). Volume of food/stomach generally increased with an increase in body size. Average volume/stomach was high compared to values reported in other studies of trout diets. Only 6.8% of the 745 stomachs examined were empty.

85-001537 Johnson, J. H. COMPARATIVE DIETS OF PAIUTE SCULPIN, SPECKLED DACE, AND SUBYEARLING STEELHEAD TROUT IN TRIBUTARIES OF THE CLEARWATER RIVER, IDAHO. *Northwest Sci.* 59(1):1-9. 1985. SFA 30(2)

[Dep. Fish Wildl., 506 S. W. Mill St., P.O. Box 3503, Portland, OR 97208]

85-001538 Keast, A. THE PISCIVORE FEEDING GUILD OF FISHES IN SMALL FRESHWATER ECOSYSTEMS. *Environ. Biol. Fishes* 12(2):119-129. 1985. SFA 30(2)

[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada] Analysis of the piscivore guild in fish species-rich lake and stream systems in eastern Ontario showed the co-occurrence of three types: (1) specialists that became piscivorous at the age of a few weeks (*Esox, Micropterus*); (2) 'secondary' piscivores that are fish-eaters only later in life (*Perca, Ambloplites*); and (3) species in which fish consumption is limited to

FOODS/FEEDING (CONTINUED)

85-001538 CONTINUED taking some larvae (*Lepomis macrochirus*). In the first group the basic series of dietary shifts that characterize many long-lived fish (i.e. zooplankton followed by small invertebrates then large invertebrates and finally fish); is greatly accelerated. Prey size increases with growth. Overall prey selection was on the basis of body size and abundance. Most piscivores took a range of fish prey. There was little evidence of specialization at the species level. *Esox* and *Micropterus* spawn some weeks ahead of their major prey sepcies. This is seen as adaptive. Their young harvest the larvae of the latter. The ensuing predator/prey association with growth is highly advantageous to the piscivore as prey of optimum body size are thus continually available.

85-001539 Kokes, J. and I. Sukop. THE FOOD OF THE FRY OF PERCH *PERCA FLUVIATILIS* IN THE MUSOV RESERVOIRS. *Folia Zool.* 33(4):349-362. 1984. In English with Czech summ. SFA 30(2)
[Inst. Vert. Zool., Russian Acad. Sci., Brno, Czechoslovakia]

85-001540 Kumar, K. P. and P. A. John. SEASONAL VARIATIONS OF THE ALLOCHTHONOUS FAUNA AND FLORA AND THEIR INFLUENCE ON THE DIET OF *RASBORA DANICONIUS* (HAMILTON). *Arch. Hydrobiol.* 102(4):537-542. 1984. SFA 30(2)
[Dep. Aquatic Biol. Fish., Univ. Kerala, Trivandrum - 695007, India]

85-001541 Lauder, G. V. and B. D. Clark. WATER FLOW PATTERNS DURING PREY CAPTURE BY TELEOST FISHES. *J. Exp. Biol.* 113:143-150. 1984. SFA 30(2)
[Dep. Anat., Univ. Chicago, 1025 E. 57th St., Chicago, IL 60637] Water flow into the mouth cavity during suction feeding in centrarchid sunfishes was studied by mapping the trajectories of small particles in the water during prey capture. In *Lepomis*, a circulation develops as the mouth opens, and water is drawn into the mouth from above, below and in front of the head. Water displaced by movement of the body as the prey is approached during the strike is entrained into the circulation towards the mouth. The parcel of water sucked into the mouth has a diameter approximately one-tenth that of the predator's length.

85-001542 Madhwal, B. P.; H. R. Singh and A. K. Chopra. MONTHLY VARIATION IN THE DIETARY HABIT OF *SCHIZOTHORAX RICHARDSONII* (GRAY) FROM THE RIVER YAMUNA IN GARHWAL HIMALAYAS. *Indian J. Anim. Sci.* 54(11):1108-1110. 1984. SFA 30(2)
[Dep. Zool., Garhwal Univ., Srinagar Garhwal, Uttar Pradesh 246 174, India]

85-001543 Maitipe, P. and S. S. De Silva. SWITCHES BETWEEN ZOOPHAGY, PHOTOPHAGY AND DETRITIVORY OF *SAROTHERODN MOSSAMBICUS* (PETERS) POPULATIONS IN TWELVE MAN-MADE SRI LANKAN LAKES. *J. Fish Biol.* 26(1):49-61. 1985. SFA 30(2)
[Dep. Zool., Univ. Ruhuna, Sri Lanka, Matara, Sri Lanka] The diet of 1200 adult *Sarotherodon mossambicus* [16-37 cm total length (T.L.)] in 12 man-made Sri Lankan lakes, belonging to five different irrigational systems were studied over four climatic seasons using volumetric analysis. Food differed between seasons and reservoirs but overall, the diet consisted of 2, 2, 6 and 15 genera of diatoms, blue-green algae, green algae, green algae and animal material respectively. However, none of the *S. mossambicus* populations maintained either a detritvorous, phytoplanktivorous or a zooplanktivorous habit through the year. Detritivory was most common during the rainy season while phytoplanktivory predominated in the dry season. Blue-green algae were not an important constituent of

FOODS/FEEDING (CONTINUED)

85-001543 CONTINUED the diet. Out of the 12 reservoir populations, five were predominantly detritivorous, six phytoplanktivorous and one zooplanktivorous. Detritus was completely absent in the ingested material in certain populations when they devoured animal or plant material, indicating the ability of *S. mossambicus* to switch from deposit to suspension feeding. The mean relative intestinal length (m.r.i.l.) of *S. mossambicus* ranged between 5.1 and 15.2. The m.r.i.l. decreased significantly with increasing body length; m.r.i.l. = 14. - 0.018 T.L. ($r=0.89$; $p< 0.001$).

85-001544 Maule, A. G. and H. F. Horton. FEEDING ECOLOGY OF WALLEYE, *STIZOSTEDION VITREUM VITREUM*, IN THE MID-COLUMBIA RIVER, WITH EMPHASIS ON THE INTERACTIONS BETWEEN WALLEYE AND JUVENILE ANADROMOUS FISHES. *NOAA Fish. Bull.* 82(2):411-418. 1984. SFA 30(2)
[Oreg. Coop. Fish. Res. Univ, Dep. Fish. Wildl., Oreg. State Univ., Corvallis 97331]

85-001545 McNicol, R. E.; E. Scherer and E. J. Murkin. QUANTITATIVE FIELD INVESTIGATIONS OF FEEDING AND TERRITORIAL BEHAVIOUR OF YOUNG-OF-THE-YEAR BROOK CHARR, *SALVENLINUS FONTINALIS*. *Environ. Biol. Fishes* 12(3):219-229. 1985. SFA 30(2)
[Freshwater Inst., Winnipeg, MB R3T 2N6, Canada]

85-001546 Minello, T. J. and R. J. Zimmerman. SELECTION FOR BROWN SHRIMP, *PENAEUS AZTECUS*, AS PREY BY THE SPOTTED SEATROUT, *CYNOSCION NEBULOSUS*. *Contrib. Mar. Sci.* 27:159-167. 1934. SFA 30(2)
[Tex. A&M Univ., Galveston] Prey selection by spotted seatrout (*Cynoscion nebulosus*) (160-210 mm TL) was examined in the laboratory to provide information on predator-prey interactions in estuarine systems. In tanks without an accessible substrate for burrowing, seatrout fed exclusively on brown shrimp (*Penaeus aztecus*) and did not eat juvenile spot(*Leiostomus xanthurus*). In tanks with a sand substrate, some spot were eaten, but selection for brown shrimp was still significant. Burrowing by shrimp into the substrate apparently reduced their availability to the predators. Prey ranged in size from 59 to 85 mm (TL), and seatrout selected shrimp and fish within the lower half of this size range. In a separate feeding trial, spotted seatrout selected juvenile spot over juvenile pinfish (*Lagodon rhomboides*).

85-001547 Mittelbach, G. GROUP SIZE AND FEEDING RATE IN BLUEGILLS. *Copeia* 1984(4):998-1000. 1984. SFA 30(2)
[Dep. Zool., Ohio State Univ., Columbus 43210]

85-001548 Munch, C. S.; R. M. Vaga and D. A. Culver. EVIDENCE FOR SIZE-SELECTIVE GRAZING OF PHYTOPLANKTON BY ZOOPLANKTON IN FISH HATCHERY PONDS. *Int. Ver. Theor. Agnew. Limnol. Verh.* 22(Part 3):1640-1644. 1984. SFA 30(2)
[Dep. Zool., Ohio State Univ., 1735 Neil Ave., Columbus, OH 43210]

85-001549 Nashida, K.; O. Tominaga; H. Miyajima and M. Ito. STUDIES OF GROUNDFISH COMMUNITIES IN THE COASTAL WATERS OF NORTHERN NIIGATA PREFECTURE. I. ESTIMATION OF DAILY FOOD CONSUMPTION OF YOUNG FLOUNDER, *PARALICHTHYS OLIVACEUS*. *Bull. Jpn. Sea Reg. Fish. Res. Lab.* No. 34. p. 1-17. 1984. SFA 30(2)
[Japan Sea Reg. Fish. Lab., Suido-cho, Niigata 951, Japan]

FOODS/FEEDING (CONTINUED)

85-001550 Naumenko, E. A. DIET OF PACIFIC CAPELIN, *MALLOTUS VILLOSUS SOCIALIS* (OSMERIDAE), IN THE BERING SEA. *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(3):130-134. 1984. SFA 30(2)
[Kamchatka Sect., TINRO Petropavlovsk, Kamchatka, USSR]

85-001551 Nicholas, J. W. and H. V. Lorz. STOMACH CONTENTS OF JUVENILE WILD CHINOOK AND JUVENILE HATCHERY COHO SALMON IN SEVERAL OREGON ESTUARIES. *Oreg. Dep. Fish Wildl. Fish Div. Prog. Rep.* No. 84-2. i + 9p. 1984. SFA 30(2)

85-001552 Olatunde, A. A. and C. C. Moneke. THE FOOD HABITS OF FOUR MORMYRID SPECIES IN ZARIA, NIGERIA. *Arch. Hydrobiol.* 102(4):503-517. 1985. SFA 30(2)
[Dep. Biol. Sci., Ahmadu Bello Univ., Zaria, Nigeria]

85-001553 Pearcy, W.; T. Nishiyama; T. Fujii and K. Masuda. DIEL VARIATIONS IN THE FEEDING HABITS OF PACIFIC SALMON CAUGHT IN GILL NETS DURING A 24-HOUR PERIOD IN THE GULF OF ALASKA. *NOAA Fish. Bull.* 82(2):391-399. 1984. SFA 30(2)
[Sch. Oceanogr., Oreg. State Univ., Corvallis 97331]

85-001554 Pimental, R.; R. V. Bulkley and H. M. Tyus. CHOKING OF COLORADO SQUAWFISH, *PTYCHOCHEILUS LUCIUS* (CYPRINIDAE), ON CHANNEL CATFISH, *ICTALURUS PUNCTATUS* (ICTALURIDAE), AS A CAUSE OF MORTALITY. *Southwest. Nat.* 30(1):154-158. 1985. SFA 30(2)
[Utah Coop. Fish. Res. Unit, UMC 52, Utah State Univ., Logan 84322]

85-001555 Prophet, C. W. CALANOID POPULATION STRUCTURE IN A KANSAS LAKE AFTER INTRODUCTION OF THREADFIN SHAD. *Southwest. Nat.* 30(1):162-163. 1985. SFA 30(2)
[Div. Biol. Sci., Emporia State Univ., Emporia, KS 66801]

85-001556 Ranta, E. and V. Nuutinen. ZOOPLANKTON PREDATION BY ROCK-POOL FISH (*TINCA TINCA* L. AND *PUNGITIUS PUNGITIUS* L.): AN EXPERIMENTAL STUDY. *Ann. Zool. Fenn.* 21(4):441-449. 1984. SFA 30(2)
[Dep. Zool., Univ. Helsinki, P. Rautatiekatu 13, SF-00100 Helsinki, Finland]

85-001557 Rask, M. and C. Hiisivuori. THE PREDATION ON *ASELLUS AQUATICUS* (L.) BY PERCH, *PERCA FLUVIATILIS* (L.), IN A SMALL FOREST LAKE. *Hydrobiologia* 121(1):27-33. 1985. SFA 30(2)
[Lammi Biol. Stn., Univ. Helsinki, SF-16900 Limmi, Finland] *Asellus aquaticus* (L.) was the most important benthic food item for perch, *Perca fluviatilis* (L.), in a small, extremely humic forest lake in southern Finland. The proportion of *A. aquaticus* in the diet of perch varied according to the former's availability, which, in turn, depended on its life cycle. Perch 11.0-12.9 cm (total length) most frequently fed on *A. aquaticus*; smaller and larger perch fed more frequently on crustacean zooplankton and aquatic insect larvae, respectively. The high density of the perch population, the importance of *A. aquaticus* in the benthos of the study lake and the general high activity level of the prey resulted in a high predation (0.1-1.8% per day). The population of *A. aquaticus* was also limited by the scarcity of macrophytic vegetation and small area of oxygenated littoral in the lake.

FOODS/FEEDING (CONTINUED)

85-001558 Ruggerone, G. T. and D. E. Rogers. ARCTIC CHAR PREDATION ON SOCKEYE SALMON SMOLTS AT LITTLE TOGIAK RIVER, ALASKA. *NOAA Fish. Bull.* 82(2):401-410. 1984. SFA 30(2)

[Fish. Res. Inst., WR-10, Univ. Wash., Seattle 98195] Observations of Arctic char feeding on migrating sockeye salmon smolts at Little Togiak River, Alaska, indicate a Type II functional response where the number of smolts consumed increased with smolt abundance. The number of smolts migrating was usually low (<20,000 smolts/24 hours) and the corresponding consumption of smolts averaged 0.8 smolts/char per 24 hours. When large smolt migrations occurred (>80,000 smolts/24 hours), char consumption of smolts generally increased to 5.6 smolts/char per 24 hours. In addition to smolt abundance, smaller smolts and longer char were correlated with an increase in the number of smolts consumed. Estimates of percent smolt mortality, based on two hypothetical char numerical responses to varying smolt abundances, indicate that smolts were migrating at densities most susceptible to predation. A comparison of length of smolts consumed by char with those in the migration shows that char consumed larger than average smolts when their stomachs were not full and smaller than average smolts when char approached stomach fullness. This may be explained by the migration of larger smolts during the feeding period of char and the possibility of char feeding less effectively when approaching fullness. Although major hatchery releases often exceed 100,000 smolts per day, these data suggest that hatchery-released smolts may be less susceptible to predation in small rivers when released during the night in large numbers (<20,000 smolts/24 hours).

85-001559 Schmitt, R. J. and S. J. Holbrook. PATCH SELECTION BY JUVENILE BLACK SURFPERCH (EMBIOTOCIDAE) UNDER VARIABLE RISK: INTERACTIVE INFLUENCE OF FOOD QUALITY AND STRUCTURAL COMPLEXITY. *J. Exp. Mar. Biol. Ecol.* 85(3):269-285. 1985. SFA 30(2)

[Dep. Biol. Sci., Univ. Calif., Santa Barbara 93106]

85-001560 Sehgal, K. L.; K. Kumar and S. Sunder. FOOD PREFERENCES OF BROWN TROUT, *SALMO TRUTTA FARIO* (LINNAEUS) IN KASHMIR. *Indian J. Anim. Sci.* 54(7):675-682. 1984. SFA 30(2)

[Cent. Inland Fish. Res. Inst., Barrackpore, West Bengal, India] The food preference of brown trout in the streams of Kashmir was studied. Trout is generally an unspecialized carnivore. At times it grazed on one species. It preferred more surface food including fish and aerial insects as it grew in size. The feeding pattern changed with seasonal changes in the benthic life. Trout uses its energy economically, repeating the same kind of movement instead of changing it for different types of food.

85-001561 Solomon, G.; K. Matsushita; M. Shimizu and Y. Nose. AGE AND GROWTH OF ROSE BITTERLING IN SHIN TONE RIVER. *Bull. Jpn. Soc. Sci. Fish.* 51(1):55-62. 1985. SFA 30(2)

[Dep. Fish., Fac. Agric., Univ. Tokyo, Bunkyo, Tokyo 113, Japan]

85-001562 Spataru, P. and M. Gophen. FEEDING BEHAVIOUR OF SILVER CARP *HYPOPHTHALMICHTHYS MOLITRIX* VAL. AND ITS IMPACT ON THE FOOD WEB IN LAKE KINNERET, ISRAEL. *Hydrobiologia* 120(1):53-61. 1985. SFA 30(2)

[Yigal Allon Kinneret Limnol. Lab., P.O.B. 345 Tiberias, Israel 14-102]

85-001563 Stedman, R. M. and R. L. Argyle. RAINBOW SMELT *(OSMERUS MORDAX)* AS PREDATORS ON YOUNG BLOATERS *(COREGONUS HOYI)* IN LAKE MICHIGAN. *J. Great Lakes Res.* 11(1):40-42. 1985. SFA 30(2)

[U.S. FWS, 1451 Green Rd., Ann Arbor, MI 48105] Examination of the stomach contents of rainbow smelt caught in bottom trawls in Lake Michigan during mid October, 1982, revealed that of 267 rainbow smelt *(Osmerus mordax)*

FOODS/FEEDING (CONTINUED)

85-001563 CONTINUED with food in their stomachs, 56% (150) had eaten young-of-the-year fish. Nearly 15% of the prey fish consumed were bloaters *(Coregonus hoyi)*, 21% were alewives *(Alosa pseudoharengus)*, and the rest could not be positively identified but were probably bloaters and alewives. Although smelt predation did not appear to have affected bloater abundance, continued increases in smelt abundance and declines in alewife populations could lead to increased predator pressure on bloater stocks, which are in the process of rebuilding.

85-001564 Tipton, K. S. THE ECOLOGICAL NICHE OF THE SKILLETFISH, *GOBIESOX STRUMOSUS*, ON A LITTORAL ROCKY SHORE IN NORTH CAROLINA. *J. Elisha Mitchell Sci. Soc.* 98(4):230-231. 1982. Abstract only. SFA 30(2)

85-001565 Wahl, D. H. and L. A. Nielsen. FEEDING ECOLOGY OF THE SAUGER *(STIZOSTEDION CANADENSE)* IN A LARGE RIVER. *Can. J. Fish. Aquatic Sci.* 42(1):120-128. 1985. In English with French summ. SFA 30(2)
[Ohio Coop. Fish. Res. Unit, Dep. Zool, Ohio State Univ., 1735 Neil Ave., Columbus 43210]

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[U.S. For. Serv., For. Sci. Lab., P.O. Box 909, Juneau, AK 99802] Small tributary streams are generally regarded as coho salmon (*Oncorhynchus kisutch*) habitat throughout the Pacific Northwest and southeast Alaska. Ponds, and particularly beaver ponds, have not shared the same reputation. This study provides a 1-year evaluation of the coho population of five beaver ponds in southeast Alaska, with population estimates above, below, and within ponds. Although low dissolved oxygen was observed in one pond, coho were present in densities comparable to those in small streams without beaver dams. Dewatering was observed below one dam during midsummer, but this did not appear to be common among the systems studied. The dams, including one approximately 2 m high, did not block adult coho migration. Beaver ponds in this study provided a large and complex volume of water for anadromous fish habitat and produced densities of coho generally higher than those reported in other systems of southwest Alaska.

85-001657 Crowder, L. B. CHARACTER DISPLACEMENT AND HABITAT SHIFT IN A NATIVE CISCO IN SOUTHEASTERN LAKE MICHIGAN: EVIDENCE FOR COMPETITION? *Copeia* 1984(4):878-883. 1984. SFA 30(2)
[Dep. Zool., N. C. State Univ., Raleigh 27695] The decline of several planktivorous fishes in Lake Michigan following the invasion of alewife (*Alosa pseudoharengus*) has often been attributed to competition for zooplankton. But shifts in resource use or trophic morphology by native fishes have not been well documented. In the 19 years following the increase of alewife, gill rakers of a native cisco, bloater (*Coregonus hoyi*), from southeastern Lake Michigan were significantly reduced both in number (by 2.1) and length (by 15%). In addition, bloaters now shift to bottom habitats and benthic prey as much as 2 years earlier in their life history than before alewife became abundant. Though the causal factors for these shifts are difficult to document, the idea that they are due to selection for benthic foraging efficiency in repsonse to alewife competition is favored by the existing data.

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[Fac. Agric., Tohuku Univ., Sendai 980, Japan] There have been controversies on whether the preadult and adult of sardine are mainly herbivores or carnivores. The results of an extensive work on the stomach contents of the sardine carried out in the seas east of Hokkaido to off Joban in their feeding period during May- December 1982, showed that the ingested food might fairly reflect the composition of environmental plankton and many sardine took more plants than animals, when compared by volume. The variations in abundance of the three Pacific sardines have well matched the long-term climatic trend, probably due to the considerable dependence of fishes on algae that are the biological products closest to solar radiation.

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[V.I. Lenin Astrakhan State Natl. Park, Astrakhan, USSR] The characteristics of temporary waterbodies are reported on the basis of several years' observations on poloy (bayou-type temporary embayments) spawning grounds of the Volga Delta. One spawning area was selected in the lower zone of the delta in which continuous observations were recorded under natural and regulated current of the Volga. The fish species composition, duration of the feeding period and downstream migration of young in years with different water levels are reported. The species and age composition of fishes utilizing the embayments are analyzed.

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[Dep. Anim. Physiol., Agric. Teachers Coll., ul. Prusa 12, 08-110 Siedlce, Poland] Studies of carp fry, *Cyprinus carpio*, showed that temperature elevation withing the range of 18-26° C increases the mortality caused by lowering the pH of water. It was found that 26-h acclimation in acidic water (mean pH 4.22) prolongs the survival of fish in water at pH 4.02-4.20. Carp fry obtained less oxygen in water at pH 4.0, as compared to pH 7.0. The differences--though insignificant--pointed to an adverse effect of acidification on the respiratory processes.

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[Univ. Cincinnati Med. Cent., Kettering Lab., 3223 Eden Ave., Cincinnati, OH 45267] Day of hatch tidewater silversides, *Menidia peninsulae*, were stocked at 5 fish per liter in 3 l of seawater at 30°/oo and raised for 16

ABUNDANCE, FACTORS OF; SURVIVAL AND MORTALITY (CONTINUED)

85-001664 CONTINUED days at 20°, 25° and 30°C. Food organisms (*Brachionus* sp. or *Artemia* nauplii) were maintained at 500, 1,000, 5,000 or 10,000 organisms per l. The influence of food density on growth of larval *M. peninsulae* was temperature dependent. At 20°C, there was no difference in final size of fish based on food densities. But at 25° and 30°C there was an increase in final body size as food density increased. There were no significant differences in survival among food densities in tests at 20°, 25° or 30°C. However, for any given temperature and food density, the number of survivors in a replicate affected the final size attained. Optimal culture condition for larval *M. peninsulae*, considering both survival and growth was determined to be 5,000 food organisms per l at 25°C.

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[Dep. Biol., Univ. Miami, P.O. Box 249118, Coral Gables, FL 33124] Freshwater fishes found in a tropical pool regularly enter a subterranean source of water. They do so mostly when fishing bats are active in the evening. If fish are experimentally attracted to the pool during this period, fishing bat activity increases. Laboratory studies demonstrate that avoiding open areas in the evening is characteristic of these fishes. Predation by fishing bats can be a selective pressure favoring cave dwelling, an alternative hypothesis on the origin of cave colonization to entrapment and directional evolution.

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85-001668 Tagart, J. V. COHO SALMON SURVIVAL FROM EGG DEPOSTION TO FRY EMERGENCE. *Proc. Olympic Wild Fish Conf.* p. 173-181. 1984. Proceedings available @ $15.00 from Dr. J. M. Walton, Peninsula Coll., 1502 E. Lauridsen Blvd., Port Angeles, WA 98362. SFA 30(2)
[Wash. State Dep. Fish., M-1 Fish Cent. WH-10, Univ. Wash., Seattle 98195] Survival from egg deposition to fry emergence, determined for 19 redds of naturally reproducing coho salmon (*Oncorhynchus kisutch*) trapped during the 1973-74 and 1974-75 spawning seasons in the Clearwater River, ranged from 0.9 percent to 77.3 percent. Intragravel environmental factors affecting survival-to-emergence were gravel particle size and permeability. Survival-to-emergence was inversely correlated with the proportion of fine sediment in the spawning gravel, the fraction <0.850 mm, and positively correlated with good gravel, the fraction <26.9 mm and >3.35 mm. Survival-to-emergence varied directly with intragravel permeability, which varied directly with the proportion of good gravel. Spawning gravel particle size also affected the size of emergent fry. Mean length of emergent fry was inversely correlated with the proportion of spawning gravel fines and intragravel dissolved oxygen, and intragravel dissolved oxygen was inversely correlated with the proportion of spawning gravel fines.

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[Fac. Fish., Nagasaki Univ., Nagasaki 852, Japan] Observations were made of predation on Atlantic silversides, *Menidia menidia*, during their spawning runs in the intertidal zone of an estuary in South Carolina. Several fishes and avian predators captured *M. menidia*. Snowy egrets, *Egretta thula*, and Great egrets, *Casmerodius albus*, were the most dominant avian predators. We found specific differences in catch mode and actual predatory pressure for the two wading birds. Before the onset of spawning runs, Snowy egrets often made hovering catches which were inefficient, while Great egrets always made standing catches, striking at *M. medidia* from a standing position. Once a spawning run began, Snowy egrets ceased hovering and both Great and Snowy egrets frequently struck at fish from a standing position. Because of inefficiency in catching prey prior to a spawning run, Snowy egrets always remained unsatiated after a run had ended. A Great egret was satiated after consuming 114 fish (42% of its body weight) during a run. Intraspecific disturbances were often observed in both Snowy and Great egrets. Interspecific interaction did not present a serious problem to the subordinate species, Snowy egret.

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[Dep. Biol. Sci., Univ. Cincinnati, Cincinnati, OH 45221] Fish were sampled from eleven sites along the Great Miami River using an electroshocking technique. Carp were censused extensively, recording the physical characteristics including size and weight, and blood samples were taken for cortisol analysis. The fish were examined thoroughly for developmental abnormalities, infection or chronic disorders. Up to 65% of the carp from some sites exhibit maladies while other sites have less than 10%. The relationship between fish maladies and environmental water quality were examined.

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[Univ. Calif., P.O. box 5507, L-453, Livermore 94550] Radioactive ^{207}Bi, produced during nuclear testing at the Pacific Proving Grounds, concentrates in the muscle tissue and organs of goatfish and certain pelagic lagoon fish from Bikini and Enewetak Atolls. It is reasonable to expect that fish capable of accumulating ^{207}Bi could also be efficient accumlators of other bismuth isotopes--namely ^{210}Bi, the daughter of naturally occurring ^{210}Pb. Therefore, ^{210}Bi and consequently ^{210}Po, the decay product of ^{210}Bi, would be expected in notable excess over the precursor ^{210}Pb in specific tissues. To test this

POLLUTION (CONTINUED)

85-001822 CONTINUED assumption, we compared concentrations of ^{210}Pb, ^{210}Bi, and ^{210}Po in muscle, liver, and bone separated from some reef species from the Marshall Islands. Concentrations of ^{210}Bi in muscle and liver were found to exceed those of its precursor by factors of 2 to 15. The excess ^{210}Bi in some species, however, is not from the environmental sources (either food or water) from which ^{207}Bi is derived. The data suggest that the excess ^{210}Bi may be translocated to muscle and liver tissue following the decay of ^{210}Pb in bone.

85-001823 Sauer, G. R. and N. Watabe. ZINC UPTAKE AND ITS EFFECT ON CALCIFICATION IN THE SCALES OF THE MUMMICHOG, *FUNDULUS HETEROCLITUS*. *Aquatic Toxicol.* 5(1):51-66. 1984. SFA 30(2)
[Mar. Sci. Proj., Belle W. Baruch Inst. Mar. Biol. Coast. Res., Univ. S.C., Columbia 29208]

85-001824 Schüler, W.; H. Brunn and D. Manz. PESTICIDES AND POLYCHLORINATED BIPHENYLS IN FISH FROM THE LAHN RIVER. *Bull Environ. Contam. Toxicol.* 34(4):608-616. 1985. SFA 30(2)
[Staatlich. Vet. Giessen, Marburger Str. 54, D-6300 Giessen, West Germany]

85-001825 Schmitt, C. J.; M. A. Ribick, J. L. Ludke and T. W. May. NATIONAL PESTICIDE MONITORING PROGRAM: ORGANOCHLORINE RESIDUES IN FRESHWATER FISH, 1976-79. *U.S. Fish Wildl. Serv. Resour. Publ.* 152. 62p. 1983. SFA 30(2)
[U.S. FWS, Columbia Natl. Fish. Res. Lab., Route 1, Columbia, MO 65201]

85-001826 Schmitt, C. J.; J. L. Zajicek and M. A. Ribick. NATIONAL PESTICIDE MONITORING PROGRAM: RESIDUES OF ORGANOCHLORINE CHEMICALS IN FRESHWATER FISH, 1980-81. *Arch. Environ. Contam. Toxicol.* 14(2):225-260. 1985. SFA 30(2)
[U.S. FWS, Columbia Natl. Fish. Res. Lab., Rt. 1, Columbia, MO 65201]

85-001827 Tait, H. D. SECTION 402 HANDBOOK. GUIDELINES FOR SCREENING NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS. *U.S. Fish Wildl. Serv.* FWS/OBS-84/05. 1984. SFA 30(2)
[Univ. South. Miss., Long Beach 39560]

85-001828 Van Coillie, R.; D. Brouard; M. Lachance and Y. Vigneault. [ECOTOXICOLOGICAL POSSIBLIITIES OF ACID PRECIPITATIONS FOR SALMON IN 4 RIVERS DRAINING THE NORTH COAST OF THE ST. LAWRENCE RIVER.] *Ann. Limnol.* 20(3):215-227. 1984. SFA 30(2)
[Cons. Sci. Technol., 1275 Blvd. Charest, Quebec, Ginacd, Canada] Regional acid precipitations (average of pH of rain and snow on the ground : 4.1 and 4.6) produce the following phenomena in the oligotrophic water of 4 rivers studied : (1) an alkalinity deficit, which already low becomes insufficient to neutralize added acidity, (2) higher concentrations of aluminium following an acid leaching of the alumino-silicates in the Canadian shield; (3) a similar increase in levels of iron, manganese and copper. These 3 phenomena are most evident during the spring snow melt. At this time pH levels fall slightly below 6.0 at the heads of the basin, the concentration of aluminum increases from upstream to downstream attaining an average of 355 µg Al/L (maximum: 894 µg/L) and, similarly, levels of iron, manganese and copper rise to 317 µg Fe/L, 16 µg Mn/L and 11 µg Cu/L on the average (respective maxima; 376 µg/L, 31 µg/L, 27 µg/L). At this time salmon are in the early alevin stages of their

POLLUTION (CONTINUED)

85-001828 CONTINUED development, a very sensitive time in the life of a fish. The ecotoxicological risks of the 3 afore-mentioned phenomena are therefore examined for *Salmo salar* in the early stages of its development. At present, both aluminium and copper present an ecotoxicological danger for salmon in these rivers: if acid precipitations continue, a lower pH (5.5 to 6.0) and iron will also become hazardous. Briefly, the development of *Salmo salar* in these rivers becomes increasingly threatened through progressive acidification of the water.

85-001829 Vostradovsky, J. and Z. Svobodová. SOME ADVERSE FACTORS AFFECTING CZECHOSLOVAK FISHERIES. *Pr. Vodnany* 12:69-74. 1983. In English with Czech summ. SFA 30(2)
[Vyzkumny Ustav Ryb. Hydrobiol., Vodnany, Prac. Dol, 252 66 Libcice nad Vltavou, Czechoslovakia]

TOXICOLOGY; BIOASSAYS

85-001830 Al-Sabti, K. FREQUENCY OF CHROMOSOMAL ABERRATIONS IN THE RAINBOW TROUT, *SALMO GAIRDNERI* RICH., EXPOSED TO FIVE POLLUTANTS. *J. Fish. Biol.* 26(1):13-19. 1985. SFA 30(2)
[Cent. Mar. Res., P.O.B. 1016, 41001 Zagreb, Yugoslavia] This work presents the results of investigations of cytogenetic changes produced by pollutants of a water ecosystem (phenol, decamethrine, Malathion, Neguvon and crude oil). The changes have been measured by observing frequency of chromosomal aberrations in the tissues of gills and kidney of rainbow trout exposed to pollutants. The fish were exposed to two dose levels of the pollutants, the lowest being the legislative maximum permissable concentration in the waters of Yugoslavia, which were used as a dose-resonse for the highest investigated concentrations. Exposure to the water polluted by chemical pollutants under investigation, raised the frequency of aberrations compared to the controls.

85-001831 Batel, R.; N. Bihari; B. Kurelec and R. K. Zahn. DNA DAMAGE BY BENZO[α]PYRENE IN THE LIVER OF MOSQUITO FISH *GAMBUSIA AFFINIS*. *Sci. Total Environ.* 41(3):275-283. 1985. SFA 30(2)
[Cent. Mar. Res. Rovinj, "Rudjer Boskovic" Inst. Zagreb, Y-52210 Rovinj, Yugoslavia]

85-001832 Benson, W. H. and W. J. Birge. HEAVY METAL TOLERANCE AND METALLOTHIONEIN INDUCTION IN FATHEAD MINNOWS: RESULTS FROM FIELD AND LABORATORY INVESTIGATIONS. *Environ. Toxicol. Chem.* 4(2):209-217. 1985. SFA 30(2)
[Div. Pharmacol. Toxicol. Nuclear Pharm., Sch. Pharm., Northeast La. Univ., Monroe 71209]

85-001833 Billard, R. and P. Roubaud. THE EFFECT OF METALS AND CYANIDE ON FERTILIZATION IN RAINBOW TROUT *(SALMO GAIRDNERI)*. *Water Res.* 19(2):209-214. 1985. SFA 30(2)
[I.N.R.A., Lab. Physiol. Poissons, 78350 Jouy-en-Josas, France]

85-001834 Blaylock, B. G.; M. L. Frank and J. F. McCarthy. COMPARATIVE TOXICITY OF COPPER AND ACRIDINE TO FISH, *DAPHNIA* AND ALGAE. *Environ. Toxicol. Chem.* 4(1):63-71. 1985. SFA 30(2)

TOXICOLOGY; BIOASSAYS (CONTINUED)

85-001834 CONTINUED
[Environ. Sci. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37831] A comparison was made of the sensitivity of fish, *Daphnia* and algae to the toxic effects of copper and acridine. A series of toxicity tests was conducted with these organisms, and the following biological endpoints determined: LC50s for fish, LC50s and effects on reproduction of *Daphnia* and 50% inhibition of the growth rate of algae. The 96-h LC50s for bluegill *(Lepomis macrochirus)* and *Daphnia magna* exposed to copper were 2.2 and 0.13 mg/L, respectively. A chronic exposure to 0.03 mg/L of copper for 14 d significantly decreased reproduction in *Daphnia.* Exposure to 0.4 and 0.2 mg/L copper inhibited the growth rate of *Selenastrum capricornutum* and *Chlorella vulgaris,* respectively, by 50%. The 96-h LC50s for fathead minnows *(Pimephales promelas)* and *D. magna* exposed to acridine were 2.3 and 3.1 mg/L, respectively. A chronic exposure to 1.25 mg/L acridine for 14 d significantly inhibited reproduction in *Daphnia,* and an exposure to 0.9 mg/L inhibited the growth rate of *S. capricornutum* by 50%. Based on the biological endpoints determined in these tests, *Daphnia* were more sensitive to copper than were fish or algae. In contrast, the most sensitive biological endpoint in tests with acridine was the inhibition of algal growth. Comparison of these test results indicates that short-term toxicity tests used for screening toxicants for possible environmental effects should include both plant and animal species.

85-001835 Broderius, S.; R. Drummond; J. Fiandt and C. Russom. TOXICITY OF AMMONIA TO EARLY LIFE STAGES OF THE SMALLMOUTH BASS AT FOUR pH VALUES. *Environ. Toxicol. Chem* 4(1):87-96. 1985. SFA 30(2)
[U.S. EPA, Duluth, MN 55804]

85-001836 Cooper, K. R.; D. T. Burton; W. L. Goodfellow and D. H. Rosenblatt. BIOCONCENTRATION AND METABOLISM OF PICRIC ACID (2,4,6-TRINITROPHENOL) AND PICRAMIC ACID (2-AMINO-4,6-DINITROPHENOL) IN RAINBOW TROUT *SALMO GAIRDNERI. J. Toxicol. Environ. Health* 14(5-6):731-747. 1984. SFA 30(2)
[Dep. Biochem. Microbiol., Cook Coll., Rutgers, New Brunswick, NJ] The bioconcentration and metabolism of picric acid and picramic acid were determined for rainbow trout. The bioconcentration factor (BCF) in epaxial muscle at 42 d for both of these compounds was less than 1; the skin had a BCF value of 1 and 9, respectively. The half-life ($t_{½}$) elimination for the high and low dose of picric acid was 12.0 and 12.5 d, respectively; and for picramic acid was 9.0 and 9.5 d, respectively. In separate experiments, approximately 34% of the injected [^{14}C] picric acid was metabolized to picramic acid, glucuronide conjugates, and an unidentified group of compounds, and 42% of the [^{14}C] picric acid was metabolized to picric acid, glucuronide conjugates, and an unidentified group of compounds. The low bioconcentration in the trout muscle may be due to the trout's ability to excrete the parent compound and metabolites. The higher radioactivity observed on the skin may be due to the water route of exposure and the binding of the parent compounds to protein.

85-001837 Cravedi, J.; G. Heuillet; J. Peleran and J. Wal. DISPOSITION AND METABOLISM OF CHLORAMPHENICOL IN TROUT. *Xenobiotica* 15(2):115-121. 1985. SFA 30(2)
[Lab. Rech. Additifs Aliment., I.N.R.A., B.p. 3, 31931, Toulouse Cedex, France]

85-001838 Dalich, G. M. and R. E. Larson. A COMPARATIVE STUDY OF THE HEPATOTOXICITY OF MONOCHLOROBENZENE IN THE RAINBOW TROUT *(SALMO GAIRDNERI)* AND THE SPRAGUE-DAWLEY RAT. *Comp. Biochem. Physiol. C Comp. Pharmacol.*

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85-001838 CONTINUED *Toxicol.* 80(1):115-122. 1985. SFA 30(2)
[R. E. Larson: Coll. Pharm., Oreg. State Univ., Corvallis 97331]

85-001839 Debeaupuis, J. and P. Lafont. [EFFECTS OF SOME MYCOTOXINS AND SYNTHETIC GENOTOXIC SUBSTANCES ON THE EMBRYONIC AND LARVAL DEVELOPMENT OF *BRACHYDANIO RERIO. C. R. Acad. Sci. Ser. III Ser. Vie* 300(5):167-170. 1985. SFA 30(2)
[I.N.S.E.R.M., Serv. Microbiol. Appl. l'alimentation Nutr., B.P. No. 40, 78110 Le Vésinet, France]

85-001840 Evtushenko, N. Y.; V. D. Romanenko and T. D. Malyzheva. METABOLIC ROLE OF ZINC IN CARP, *CYPRINUS CARPIO* (CYPRINIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):134-140. 1984. SFA 30(2)
[Inst. Hydrobiol., Kiev, USSR]

85-001841 Geen, G. H.; J. D. Neilson and M. Bradford. EFFECTS OF pH ON THE EARLY DEVELOPMENT AND GROWTH AND OTOLITH MICROSTRUCTURE OF CHINOOK SALMON, *ONCORHYNCHUS TSHAWYTSCHA. Can. J. Zool.* 63(1):22-27. 1985. In English with French summ. SFA 30(2)
[Dep. Biol. Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada]

85-001842 Gill, T. S. and J. C. Pant. ERYTHROCYTIC AND LEUKOCYTIC RESPONSES TO CADMIUM POISONING IN A FRESHWATER FISH, *PUNTIUS CONCHONIUS* HAM. *Environ. Res.* 36(2):327-337. 1985. SFA 30(2)
[Dep. Zool., Th. D.S.B. Coll., Kumaun Univ., Naini Tal 263 002, India]

85-001843 Gill, T. S. and J. C. Pant. MERCURY-INDUCED BLOOD ANOMALIES IN THE FRESHWATER TELEOST *BARBUS CONCHONIUS* HAM. *Water Air Soil Pollut.* 24(2):165-171. 1985. SFA 30(2)
[Dep. Zool., Fac. Sci., Kumaun Univ., Naini Tal-263 002, India]

85-001844 Hawkins, W. E. ULTRASTRUCTURE OF RODLET CELLS: RESPONSE TO CADMIUM DAMAGE IN THE KIDNEY OF THE SPOT *LEIOSTOMUS XANTHURUS* LACÈPÉDE. *Gulf Res. Rep.* 7(4):365-372. 1984. SFA 30(2)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564]

85-001845 Hawkins, W. E.; R. M. Overstreet and M. J. Provancha. EFFECTS OF SPACE SHUTTLE EXHAUST PLUMES ON GILLS OF SOME ESTUARINE FISHES: A LIGHT AND ELECTRON MICROSCOPIC STUDY. *Gulf Res. Rep.* 7(4):297-309. 1984. SFA 30(2)
[Gulf Coast Res. Lab., Ocean Springs, MS 39564] The first few launches of the space shuttle resulted in fish kills in a lagoon near the launch site. To study this phenomenon further, sheepshead minnow (*Cyprinodon variegatus*), sailfin molly (*Poecilia latipinna*), and mosquitofish (*Gambusia affinis*) were exposed to the exhaust plume in buckets placed near the launch site. An open bucket provided a full exposure, a partly closed one provided an intermediate exposure, and a closed one was the control. Three h after launch, the pH of the water from the full exposure had decreased from about 7 to about 3, Al and Fe levels had increased, and some fish had died. Gills of most fishes from full exposures and some from intermediate exposures were damaged. Gills, however, exhibited no aneurysms, mucus coagulation, or hemorrhaging. Some secondary lamellae swelled, some fused with adjacent lamellae, and others clubbed or retracted into the filament. Many lamellar pavement cells died and sloughed off. Mucus cells of intermediate exposure

TOXICOLOGY; BIOASSAYS (CONTINUED)

85-001845 CONTINUED specimens bulged on the filament surface and pavement cells lost their microridges. Mineral deposits, probably aluminum oxide, occurred on gills of fishes from full exposures. Focally, pavement cells were eroded exposing the underlying structures. The sudden pH drop in the full exposures probably caused the gill damage. However, we could not determine the effect of previous exposure on the experimental fish, or whether gill damage was the lethal lesion. The possibliliy is indicated that some fish recover after exposure to the exhaust plume.

85-001846 Helder, T. and W. Seinen. STANDARDIZATION AND APPLICATION OF AN E.L.S.-BIOASSAY FOR PCDDs AND PCDFs. *Chemosphere* 14(2):183-193. 1985. SFA 30(2)
[Fac. Vet. Med., State Univ. Utrecht, Biltstr. 172, 3572 BP Utrecht, Netherlands] An early life stage bioassay (E.L.S.-bioassay) for the determination of polychlorinated dibenzo-p-dioxins and dibenzofurans in complex matrices has been developed. The bioassay is based upon mortality, resulting from a typical toxicopathological syndrome in rainbow trout eleutheroembryos. Its reliability is demonstrated by the application to incinerator fly ash. It is concluded, that the E.L.S.-bioassay is a simple, useful and relatively inexpensive method to determine the amount of PCDDs and PCDFs in potentially contaminated environmental samples.

85-001847 Jagoe, C. H. and T. A. Haines. FLUCTUATING ASYMMETRY IN FISHES INHABITING ACIDIFIED AND UNACIDIFIED LAKES. *Can. J. Zool.* 63(1):130-138. 1985. In English with French summ. SFA 30(2)
[U.S. FWS, Dep. Zool., Univ. Me., Orono 04469]

85-001848 Johansen, P. H.; R. A. S. Mathers; J. A. Brown and P. W. Colgan. MORTALITY OF EARLY LIFE STAGES OF LARGEMOUTH BASS, *MICROPTERUS SALMOIDES* DUE TO PENTACHLORPHENOL EXPOSURE. *Bull. Environ. Contam. Toxicol.* 34(3):377-384. 1985. SFA 30(2)
[Dep. Biol., Queen's Univ., Kingston, ON K7L 3N6, Canada]

85-001849 Koivusaari, U.; M. Pesonen and O. Hänninen. POLYSUBSTRATE MONOOXYGENASE ACTIVITY AND SEX HORMONES IN PRE- AND POSTSPAWNING RAINBOW TROUT *(SALMO GAIRDNERI). Aquatic Toxicol.* 5(1):67-76. 1984. SFA 30(2)
[Dep. Physiol., Univ. Kuopio, Box 6, SF-70211-Kuopio 21, Finland]

85-001850 Lacroix, G. L. SURVIVAL OF EGGS AND ALEVINS OF ATLANTIC SALMON (*SALMO SALAR*) IN RELATION TO THE CHEMISTRY OF INTERSTITIAL WATER IN REDDS IN SOME ACIDIC STREAMS OF ATLANTIC CANADA. *Can. J. Fish. Aquatic Sci.* 42(2):292-299. 1985. In English with French summ. SFA 30(2)
[Biol. Stn., St. Andrews, NB EOG 2XO, Canada]

85-001851 McIntyre, H. K., Jr. DEVELOPMENT OF THE FATHEAD MINNOW: HISTOGENESIS OF THE DIGESTIVE AND EXCRETORY SYSTEMS AND TOXICITY OF MALACHITE GREEN TO EMBRYOS. *Ph.D. dissertation, Auburn Univ.* 69p. 1984. From Diss. Abstr. Int. B Sci. Eng. 45(9):2749. 1985. SFA 30(2)

85-001852 McKim, J.; P. Schmieder and G. Veith. ABSORPTION DYNAMICS OF ORGANIC CHEMICAL TRANSPORT ACROSS TROUT GILLS AS RELATED TO OCTANOL-WATER PARTITION COEFFICIENT. *Toxicol. Appl. Pharmacol.* 77(1):1-10. 1985.

TOXICOLOGY; BIOASSAYS (CONTINUED)

85-001852 CONTINUED SFA 30(2)
[U.S. EPA, 6201 Congdon Blvd., Duluth, MN 55804]

85-001853 Natarajan, G. M. INDUCTION OF BRANCHIAL ENZYMES IN SNAKE HEAD *(CHANNA STRIATUS)* BY OXYDEMETON-METHYL. *Pestic. Biochem. Physiol.* 23(1):41-46. 1985. SFA 30(2)
[Dep. Zool., Bharathiar Univ., Coimbatore-641 046, Tamil Nadu, India]

85-001854 Nebeker, A. V.; C. Savonen and D. G. Stevens. SENSITIVITY OF RAINBOW TROUT EARLY LIFE STAGES TO NICKEL CHLORIDE. *Environ. Toxicol. Chem.* 4(2):233-239. 1985. SFA 30(2)
[U.S. EPA, Corvallis Environ. Res. Lab., Corvallis, OR 97333]

85-001855 Nemcsók, J.; Á. Németh; Z. Buzás and L. Boross. EFFECTS OF COPPER, ZINC AND PARAQUAT ON ACETYLCHOLINESTERASE ACTIVITY IN CARP (*CYPRINUS CARPIO* L.). *Aquatic Toxicol.* 5(1):23-31. 1984. SFA 30(2)
[Dep. Biochem., Attila József Univ., H-6701 Szeged, P.O. Box 533, Hungary]

85-001856 Niimi, A. J. and V. Palazzo. TEMPERATURE EFFECT ON THE ELIMINATION OF PENTACHLOROPHENOL, HEXACHLOROBENZENE AND MIREX BY RAINBOW TROUT *(SALMO GAIRDNERI). Water Res.* 19(2):205-207. 1985. SFA 30(2)
[Dep. Fish. Oceans, Can. Cent. Inland Waters, Burlington, ON L7R 4A6, Canada]

85-001857 Peterson, R. H.; J. L. Metcalfe and S. Ray. UPTAKE OF CADMIUM BY EGGS AND ALEVINS OF ATLANTIC SALMON (*SALMO SALAR*) AS INFLUENCED BY ACIDIC CONDITIONS. *Bull. Environ. Contam. Toxicol.* 34(3):359-368. 1985. SFA 30(2)
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85-001858 Pickering, A. D. and T. G. Pottinger. ACCLIMATION OF THE BROWN TROUT, *SALMO TRUTTA* L., TO THE STRESS OF DAILY EXPOSURE TO MALACHITE GREEN. *Aquaculture* 44(2):145-152. 1985. SFA 30(2)
[Freshwater Biol. Assoc., The Ferry House, Far Sawrey, North Ambleside, Cumbria, England]

85-001859 Robinson, J. W. and P. M. Deano. THE SYNERGISTIC EFFECTS OF ACIDITY AND ALUMINUM ON FISH (GOLDEN SHINERS) IN LOUISIANA. *J. Environ. Sci. Health A Environ. Sci. Eng.* 20(2):193-204. 1985. SFA 30(2)
[Chem. Dep., La. State Univ., Baton Rouge 70803]

85-001860 Roy, W. R.; I. G. Krapac, R. A. Griffin; D. R. Dickerson, R. M. Schuller and N. F. Shimp. GEOCHEMICAL PROPERTIES OF COAL WASTES AND THE TOXICOLOGICAL EFFECTS ON AQUATIC LIFE. *Ill. Environ. Geol. Notes* 197. vii + 124p. 1984. SFA 30(2)
[State Geol. Surv., Nat. Resour. Bldg., Champaign, IL 61820]

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85-001861 Sahib, I. K. A. S.; K. S. P. Rao; K. R. S. S. Rao and K. V. R. Rao. REGULATION OF ACIDIC AND BASIC TYPES OF PROTEINS OF A TELEOST *TILAPIA MOSSAMBICA* UNDER SUBLETHAL MALATHION IMPACT. *Indian J. Fish.* 30(2):314-319. 1983. SFA 30(2)
[Dep. Zool., S. V. Univ., P. G. Cent., Kavali 524202, India]

85-001862 Sastry, K. V. and A. A. Siddiqui. EFFECT OF THE CARBAMATE PESTICIDE SEVIN ON THE INTESTINAL ABSORPTION OF SOME NUTRIENTS IN THE TELEOST FISH, *CHANNA PUNCTATUS*. *Water Air Soil Pollut.* 24(3):247-252. 1985. SFA 30(2)
[Environ. Toxicol. Lab., Dep. Zool., D.A.V. (P.G.) Coll., Muzaffarnagar-251001, India]

85-001863 Sastry, K. V. and K. Subhadra. *IN VIVO* EFFECTS OF CADMIUM ON SOME ENZYME ACTIVITIES IN TISSUES OF THE FRESHWATER CATFISH, *HETEROPNEUSTES FOSSILIS*. *Environ. Res.* 36(1):32-45. 1985. SFA 30(2)
[Dep. Zool., M. D. Univ., Rohtak (Haryana), India]

85-001864 Saxena, P. K. and K. Mani. QUANTITATIVE STUDY OF TESTICULAR RECRUDESCENCE IN THE FRESHWATER TELEOST, *CHANNA PUNCTATUS* (BI.) EXPOSED TO PESTICIDES. *Bull. Environ. Contam. Toxicol.* 34(4):597-601. 1985. SFA 30(2)
[Dep. Zool., Fac. Basic Sci., Punjab Agric. Univ., Ludhiana-141004, India]

85-001865 Scarano, G. and M. G. Saroglia. RECOVERY OF FISH FROM FUNCTIONAL AND HAEMOLYTIC ANAEMIA AFTER BRIEF EXPOSURE TO A LETHAL CONCENTRATION OF NITRITE. *Aquaculture* 43(4):421-426. 1984. SFA 30(2)
[Natl. Counc. Res., CNR-ISBL, Lesina (FG), Italy] Total haemoglobin and methaemoglobin concentration in blood was analyzed in sea bass *(Dicentrarchus labrax)* exposed for 18 h to 150 mg/l NO_2-N in sea water. Observations of recovery mechanisms carried out for 24 days following the nitrite exposure showed that, after a rapid dissapearance of methaemoglobinaemia, a strong anaemia occurred, due to a drop in the total haemoglobin concentration. Complete recovery from this anaemia occurred only after 24 days. The mechanism of recovery from nitrite intoxication is discussed with a view to devising treatment that might help to minimize losses at fish-farming facilities.

85-001866 Simakov, Y. G. EFFECT OF HARMFUL FACTORS ON THE POSTTRAUMATIC MITOTIC ACTIVITY IN THE LENS EPITHELIUM OF RAINBOW TROUT, *SALMO GAIRDNERI* (SALMONIDAE). *J. Ichthyol. (Engl. Transl. Vopr. Ikhtiol.)* 24(4):35-49. 1984. SFA 30(2)
[VZIPP, Moscow, USSR]

85-001867 Siva Prasada Rao, K.; K. R. S. Sambasiva Rao; K. Sathya Prasad and K. V. Ramana Rao. METHYL PARATHION IMPACT ON THE ESTERASES OF A FRESHWATER TELEOST *TILAPIA MOSSAMBICA* (PETERS). *Indian J. Fish.* 30(1):148-154. 1983. SFA 30(2)
[Dep. Neurol. Pharmacol. Toxicol., Univ. Miss. Med. Cent., 2500 North State St., Jackson 39216]

85-001868 Soderberg, R. W. HISTOPATHOLOGY OF RAINBOW TROUT, *SALMO GAIRDNERI* RICHARDSON, EXPOSED TO DIURNALLY FLUCTUATING UN-IONIZED AMMONIA LEVELS IN STATIC-WATER PONDS. *J. Fish Dis.* 8(1):57-64. 1985. SFA 30(2)

TOXICOLOGY; BIOASSAYS (CONTINUED)

85-001868 CONTINUED
[Dep. Biol., Mansfield Univ. Pa., Mansfield 16933] Rainbow trout, *Salmo gairdneri* Richardson, were reared intensively in nine aerated static-water ponds. Dissolved oxygen concentrations were maintained above 5 mg/l and unionized ammonia (NH_3) levels were monitored in all ponds. Fish were removed periodically and gill, liver and trunk kidney samples were removed for histological examination. Average NH_3 concentrations did not exceed a previously reported chronically toxic level, but average daily maximum concentrations exceeded this level in all but two ponds. Gills exhibited lesions characteristic of those attributed to ammonia exposure in all ponds and fish with the most damaged gills had livers demonstrating reduced glycogen vacuolation. No histological changes were noted in kidney tissue. Because gills were damaged even though average NH_3 levels were quite low, it is recommended that research in static water carefully consider the cyclical nature of NH_3 concentrations.

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[NMFS, Bldg. 204, Naval Stn., Seattle, WA 98115] The structure of anadromous salmonid species is not compatible with definition of manageable units for the convenience of man. Acknowledging this problem, biologists generally have accepted separation of species populations into stocks based on the degree to which they are reproductively isolated. Methods to identify the distribution and abundance of these stocks are based on the fact that reproductively isolated groups have different gene frequencies, or on the fact that locally adapted stocks are maladapted when transplanted. Although these methods often provide less than satisfactory data for stock separation, the data that have been obtained indicate that the concept of a "stock" is too restrictive to be applicable in the management of anadromous salmonids. "Management units"--units that may include from one to several stocks--are discussed as a possible alternative for overcoming the futility of attempting management of stocks as separate entities.

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[Quinault Dep. Nat. Resour., Quinault Indian Nation, P.O. Box 189, Taholah, WA 98587] Nearly all fisheries managers agree that wild fish are nice to have around, but for different reasons, depending upon significance to their constituents. Statements of official policy are unlikely to protect wild fish since decisions must ultimately be made on individual stocks, not broad generalities. Several factors pressure against protection, the most notable of which are the reliance of current fisheries upon mixed-stock exploitation patterns and the short-term perspectives of harvesters and administrators. Because wild fish are commonly impacted by fisheries regulated under a complex maze of political jurisdictions, actions by individual managers will generally prove insufficient to provide necessary protection.

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Stream channel alterations are alleged to have detrimental effects on the stream fauna, particularly the sport fishery. Four study sites were chosen to evaluate the quantitative effects of channel alterations on a brown trout population: (1) an unaltered control; (2) an area dredged twice during the course of the study; (3) an area bulldozed 4 years prior to study, half of which was bulldozed again during the study; (4) an area bulldozed 4 years prior to study, 400 meters of which has remained channelized and 100 meters of which has reverted to natural meandering. Population estimates were made approximately bi-monthly for at least a year in each site. Analysis of variance was used to compare among sites for average total density and biomass, and total production per interval. Dredging had less effect on the population than did bulldozing. Populations in the bulldozed sites were most severely effected in those areas that had retained the greatest degree of artificial configuration. The youngest and oldest age groups were most severely effected by stream alterations. Growth was not affected by channel alterations. A technique was developed for quantitatively defining the precise microhabitat of a stream dwelling species *in situ*. Scuba equipment was modified to allow observations of fish in high velocity steams and at low temperatures. An air-exhaust system prevented bubbles from disturbing the fish. A sonic transmitter-receiver allowed the diver to communicate with the surface personnel who monitored the instruments and recorded data. Brown trout microhabitat was measured by life stage (age 0, juvenile, and adult) and physical activity from summer through winter for a wide variety of stream habitats in two different river systems. Water velocity at fish location, water depth, fish depth, substrate, and overhead light appear to be the most important of the physical parameters monitored in defining brown trout microhabitat. Physical activity and life stage of the fish were vital subdivisions in defining microhabitat requirements. Trout selected specific microhabitat areas from the range of habitat available in each stream. The adverse affects observed for channel alterations can be explained in terms of microhabitat requirements.

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[316 E. Myrtle St., Boise, ID 83702] Conventionally managed cattle allotments graze riparian types more heavily than the uplands. To get the prescribed use in the riparian zone that is compatible with fishery habitat needs can be gained through the use of the riparian pasture. Riparian pastures have the potential of converting poorly managed allotments to successfully managed.

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REGULATIONS

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[U.S. FWS, P.O. Box 18, Ahsahka, ID 83520] For over 30 years the primary management emphasis on wild salmonids in Yellowstone National Park has been the use of highly restrictive sport fishing regulations. Although restoring more natural (i.e., pristine) populations for their own intrinsic value was an important objective, each more restrictive rule most often came about as the direct result of excessive harvests and a deterioration in angling quality. These regulations, particularly since 1973, have significantly helped to restore population numbers and improve age-group hierarchies. According to the defined interests of a large and diverse cross section of sport anglers from across North America, a greater sustained recreational yield can be created by restrictive regulations than by other management scenarios, and at lesser cost. A simplified economic example of the relative value of a wild cutthroat fishery shows that one 14.5 km reach of the Yellowstone River provided more angler entertainment than one moderately sized trout hatchery could probably produce. Each salmonid species reacted to similar regulations in different ways, as did populations of the same species in different types of waters. The cutthroat trout, however, is particularly suited to catch-and-release only fisheries because of its extraordinary vulnerability to angling, low release mortality, and long life. As such, the species has shown to provide sport angling in the upper limits of optimum, as defined by the fishermen themselves.

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[Cole Rivers Hatchery, Oreg. Dep. Fish Wildl., Trail 97541]

STOCKING AND INTRODUCTIONS

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[Idaho Dep. Fish Game, 5205 S. 5th Ave., Pocatello 83204]

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Factors potentially influencing the short-term survival of stocked muskellunge fingerlings were assessed in a series of releases in 20 Wisconsin waters. Date of stocking, water temperature at time of stocking, and presence of predators appear to be major factors affecting survival. Survival was greater when fish were released late in the season in waters 60-65 F or cooler. Better survival was achieved in 4 waters with no predators than in 16 lakes with predators. Seven- to 9-inch fish survived about 87% as well as 9- to 12-inch fish, indicating that hatchery efforts could be reduced by not rearing fingerlings over 9 inches. However, very small fingerlings (2.3-inch average) suffered almost complete mortality after stocking. Survival of muskellunge fingerlings was not affected by finclipping, sedation, numbers stocked, or in-lake conditioning before release. There was no significant relationship between survival and the biomass of forage fish or between survival and a number of physical-chemical factors. Recommendations for management include: (1) discontinue stocking muskellunge in the 2- to 3-inch size range, (2) concentrate on rearing 7- to 9-inch fish, (3) begin stocking in late August when temperatures are no warmer than 60-65 F, and (4) make any efforts possible to reduce stress from handling and transport of fingerlings.

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LAKE MANAGEMENT AND RESEARCH (CONTINUED)

85-001952 CONTINUED more abundant of the 2 species by number and by biomass. The 1969 year class was the largest produced in the 10-year period, and overcrowding apparently caused severe mortality in 1971. The 1st 2 yellow perch year classes grew faster than succeeding year classes; later maturity was observed along with the slower growth. Population estimates of adult smallmouth bass were higher than the single pretreatment estimate and higher than those for 2 other lakes in the region. The strongest year class was produced in 1970 and it was more abundant than any other year class at Ages 0 and II-IV. Growth rates were exceptional for the 1st 3 year classes, then declined to levels comparable to other northern Wisconsin lakes. The 1967 and 1970 year classes of smallmouth bass contributed 20 and 30%, respectively, of their estimated numbers to the harvest at Ages II-VI. However, total survival was much higher for the 1970 year class. Exploitation rates during the study period averaged 0.40 for bass and 0.14 for perch. Age III smallmouth bass were more heavily exploited than older fish. Natural and fishing mortality were about equal for smallmouth bass for all ages and years combined. Natural mortality was considerably higher than angling mortality for the 1967 yellow perch year class at Ages I-IV.

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The life cycle of red drum (*Sciaenops ocellatus*) is generally well known and consists of spawning in the Gulf of Mexico or Atlantic Ocean in the late summer and fall, utilization of estuarine nurseries, and return to the gulf or ocean at age III to V. However, many details of the life history are unclear or unknown. Estimates of life history parameters except length-weight relationships are generally imprecise, undocumented, or unknown. Long-term trends in size composition and stock abundance are generally unknown, but recent evidence suggests that recent recruitment to the spawning population may have been small, in part possibly associated with lack of hurricanes during the spawning season. Spawner-recruit relationships have not been examined. Habitat requirements are generally unknown. Red drum harvest has occurred mainly in estuaries throughout the year by commercial and recreational fishermen. The exact harvest is unknown but exceeds 500,000 fish and 500,000 kg. Less than 636 commercial fishermen using nets and trotlines harvest most of these fish. There are at least 500,000 red drum anglers. Total economic impacts (retail level) of commercial fishermen were generally less than $7 million while those of anglers were over $118 million. The commercial fishery supplied at least 66,000 consumers with red drum, while the recreational fishery supplied at least 61,000 consumers. Red drum populations do not have a great biological capacity to withstand growth overfishing. Therefore, a conservative approach to management of this species is suggested, especially since the best available data indicate growth overfishing has occurred. This has been the approach of past management, but increasing fishing demands might warrant additional action for conservative management. Possible alternatives are presented, including: harvest restrictions, habitat improvements, stocking, and participant limitations.

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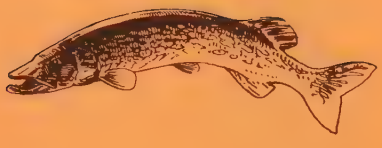

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North Carolina: Cape Fear Estuary
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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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